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Introduction

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Scientific and Technical Information Division
National Aeronautics and Space Administration

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VOLUME 2 NUMBER 8

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

April 23, 1964

01 GENERAL

Includes administration and management; space law and related legal matters; legislative hearings and documents; and symposia or conferences of a broad or general nature.

N64-16351 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SCIENCE AND LIFE (SELECTED ARTICLES)
10 Dec. 1962 52 p Transl. into ENGLISH of 3 articles from Nauka i Zhizn' (Moscow), no. 9, 1962 p 2–10, 15–19, and 54–60
(FTD-TT-62-1518/1+2; AD-294530)

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1. FIVE DAYS WHICH ELECTRIFIED THE WORLD O. G. Gazenko p 1–18 (See N64-16352 08-32)
2. BIOLOGY AND FLIGHTS INTO THE COSMOS N. N. Zhukov-Verezhnikov (Acad. Med. Sci. USSR) and V. Ya. Kopyev p 19–30 (See N64-16353 08-16)
3. THROUGH THE COSMOS—INTO THE MICROCOSM G. B. Zhdanov p 31–43 (See N64-16354 08-28)

N64-16496 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
TACTICAL AIR WARFARE FORCE ALLOCATION. VOLUME I: PROGRAM SUMMARY Final Report
Edwin W. Roth Bedford, Mass., Directorate of Systems Design, Oct. 1963 81 p refs
(Contract AF 19(628)-2801)
(ESD-TDR-63-664, Vol. 1; AD-430731)

The primary emphasis of the current research program is directed toward the formulation of a detailed data base, and the structuring of existing and newly developed analytical models of an Air Component Commander's daily force allocation planning function. The information organization and models are applicable to the assignment of air resources among the tactical air missions of air superiority, interdiction, direct air support, and reconnaissance. This volume presents a description and analysis of the current operations force allocation decision, and a technical summary of the data base and the compendium of force allocation planning models.
Author

N64-16511 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
TACTICAL AIR WARFARE FORCE ALLOCATION VOLUME II AIR FORCE FORCE ALLOCATION DATA BASE [Final Report]
Edwin W. Roth Bedford, Mass., Directorate of Systems Design, Oct. 1963 168 p refs
(Contract AF 19(628)-2801)
(ESD-TDR-63-664, Vol. 2; AD-430877)

This volume is devoted exclusively to the presentation of the Air Force Force Allocation Data Base. The materials included are the description of the data base structure, the files, object rolls and properties within the structure, the vocabulary and glossary of abbreviations employed, and a gross estimate of the computer storage requirements.
Author

N64-16653 Dunlap and Associates, Inc., Darien, Conn.
MAN-COMPUTER SYSTEMS AND ALLOCATION OF RESOURCES PROBLEMS Progress Report No. 3
U. O. Gagliardi, Ira Kaplan, and L. L. Vallerie Jan. 1964 72 p refs
(Contract Nonr-3602(00))
(AD-430035)

The work reported concerns the observation of problem-solving behavior exhibited by subjects who were given an allocation-of-resources task. The task was to deploy Polaris-like weapon systems against a given target system under stated constraints. Although the task is formulable as an integer linear programing problem, the subjects solved it by resorting to heuristic procedures. These procedures, as well as the solutions produced, seem to indicate that a problem solver may encounter considerable difficulty in uncovering the ordering of decision alternatives, if this ordering is a partial one. Following the study of unaided performance, two distinct computer-aid concepts were developed and tested.
Author

N64-16654 Office of Research Analyses, Holloman AFB, N. Mex.
ON A DAMAGE MODEL FOR BOMB ATTACKS UNDER CONSIDERATION OF OVERLAPPINGS Technical Report
Herbert Knothe Dec. 1963 15 p
(ORA-63-16; AD-429530)

The expected damage caused by bomb attacks on large areas is represented as a double integral for any geometrical

shape and size of the target under mathematically rigorous consideration of (1) overlappings, (2) the fact that the damage done to a target point is a monotonically decreasing function of the distance explosion-target point, (3) density (weight function), and (4) hardening. Author

N64-16729* National Aeronautics and Space Administration, Washington, D.C.
A REVIEW OF NASA'S NEW SCIENTIFIC AND TECHNICAL INFORMATION PROGRAMS
Hubert E. Sauter Wright-Patterson AFB, Ohio, Aeron. Systems Div., May 1963 6 p *In* Proc. Symp. on Mater. Inform. Retrieval held at Dayton, Ohio, 28–29 Nov. 1962

A general discussion is given of the information storage, retrieval, and dissemination program of NASA as operated by Documentation, Incorporated. Five operating principles by which the program is guided are given. The discussion is concerned mostly with acquisition and bibliographic control. C.L.W.

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc. *For related information see*: 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 11 Fluid Mechanics.

N64-16255 Aerospace Corp., El Segundo, Calif.
NONEQUILIBRIUM INVISCID FLOW ABOUT BLUNT BODIES
R. H. Lee and S. T. Chu 20 Jan. 1964 61 p refs
(Contract AF 04(695)-269)
(TDR-269(4560-10)-2; SSD-TDR-63-369; AD-430426)

An inverse method was used for analyzing the chemical nonequilibrium flow about a blunt body. This method starts with an assumed form of shock shape. The flow field and the thermodynamics behind the shock is determined by means of a finite difference mesh scheme. The calculation is continued until the sonic point on the body is exceeded. Mass flow rate is then integrated along the curvilinear coordinate normal to the shock to determine the locations and shapes of the body and the streamlines. The analysis assumes air to be a five-component reacting gas undergoing six coupled reactions with negligible ionization. Complete rate equations, including three-body recombinations, are used. Numerical examples are given for frozen and nonequilibrium airflows. Three different kinetic models are used for the reacting cases. The results show that, even though the pressure and velocities in the shock layer are not sensitive to the air kinetics, the other thermodynamic properties are significantly influenced by the kinetic models chosen. Author

N64-16356 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATING FINNED DIFFUSORS
V. K. Migay 3 Apr. 1963 11 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 10, Oct. 1962 p 55–59
(FTD-TT-63-86/1+2; AD-402582)

The results of experimentally investigating the influence of various geometric parameters on the effectiveness of a finned diffusor are presented. Round and annular diffusors were studied. Data are included on: the dependence of diffusor effectiveness upon the angle of expansion; the dependence of the coefficient of impact completeness upon the angle of diffusor expansion; the velocity fields in an annular finned diffusor; pressure distribution in interfin hollows; and the effect of the number of ribs on the effectiveness of a finned diffusor. R.T.K.

N64-16366 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HYPERSONIC FLOW PAST AXISYMMETRIC BODIES FLYING AT AN ANGLE OF ATTACK
B. B. Minostsev 14 Jun. 1963 22 p refs Transl. into ENGLISH from Russian book "Issledovaniya po Mekhanike i Prikladnoy Matematike" Tr. Inst., no. 7, 1961 p 136–151
(FTD-TT-63-406/1+2+4; AD-413074)

Presented is the solution to the problem of the flow of an ideal gas moving at supersonic velocity past axisymmetric bodies at angle-of-attack. The problem was solved by expanding the unknown characteristics of the flow into a series with respect to parameter $\epsilon = (\gamma - 1)/(\gamma + 1)$. Author

N64-16388 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ENGINEERING JOURNAL (SELECTED ARTICLES)
15 Oct. 1963 26 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 3, no. 2, 1963 p 207–221
(FTD-TT-63-969/1+2; AD-425360)

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1. ON THE CONFIGURATION OF FORWARD SEPARATION ZONES DURING SYMMETRICAL FLOW AROUND BODIES WITH SUPERSONIC GAS FLOW V. Ya. Neyland and G. I. Taganov p 1–12 refs (See N64-16389 08-02)
2. DETERMINING THE AERODYNAMIC FORCES AFFECTING A BODY WITH FORWARD SEPARATION ZONES AT HYPERSONIC FLOW VELOCITIES V. G. Bukovshin and G. I. Taganov p 13–22 refs (See N64-16390 08-02)

N64-16389 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE CONFIGURATION OF FORWARD SEPARATION ZONES DURING SYMMETRICAL FLOW AROUND BODIES WITH SUPERSONIC GAS FLOW
V. Ya. Neyland and G. I. Taganov *In its* Eng. J. (Selected Articles) 15 Oct. 1963 p 1–12 refs (See N64-16388 08-02)

The determination of the geometrical parameters of the forward separation zones, when a supersonic gas flow is directed around symmetrical bodies at a zero angle-of-attack, is discussed. The determination of the dependence of the angle-of-incidence of the supersonic gas flow on the boundary of the stagnation zone at the surface of the body permits the determination of: (1) the location of the flow with a separation zone; (2) the magnitude of the "opening" angle of the stagnation zone at a given Mach number; and (3) the fixed beginning of the separation zone, relative to the nose of a symmetrical body, at a zero angle-of-attack. I.v.L.

N64-16390 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINING THE AERODYNAMIC FORCES AFFECTING A BODY WITH FORWARD SEPARATION ZONES AT HYPERSONIC FLOW VELOCITIES
V. G. Bukovshin and G. I. Taganov *In its* Eng. J. (Selected Articles) 15 Oct. 1963 p 13–22 refs (See N64-16388 08-02)

This report discusses the use of the known Newton method, plus additional assumptions, in determining the aerodynamic

forces acting on any given body, around which the hypersonic flow is directed, resulting in the formation of a separation zone of a given configuration. The aerodynamic coefficients were calculated for a sphere with a needle and for a cone with a needle, and a mathematical investigation was made of the effect of the "opening" angle of a liquid cone (separation zone boundaries) and the angle-of-attack of the aerodynamic forces on bodies of an arbitrary form. I.v.L.

N64-16394 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NONEQUILIBRIUM FLOW OF AIR IN NOZZLES
S. I. Anisimov and G. S. Romanov 16 Oct. 1962 12 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (USSR) no. 1, Jan.–Feb. 1962 p 76–81
(FTD-TT-62-1278/1+2; AD-292225)

Certain problems are evaluated that concern the kinetics of establishing equilibrium between progressive and inert degrees of freedom of molecules at high temperatures in air. Equations are obtained describing monodimensional flow of air during nonequilibrium oscillations and oxygen and nitrogen dissociations. Simple boundary cases are investigated. The airflow takes place in a nozzle, taking into consideration nonequilibrium oscillations and dissociations. C.L.W.

N64-16466 Minnesota U., Minneapolis St. Anthony Falls Hydraulic Lab.
A QUASI-LINEAR AND LINEAR THEORY FOR NON-SEPARATED AND SEPARATED TWO-DIMENSIONAL, INCOMPRESSIBLE, IRROTATIONAL FLOW ABOUT LIFTING BODIES
C. S. Song May 1963 40 p refs
(Contract Nonr 710(24))
(Tech. Paper-43, Ser. B; AD-423579)

A general theory is developed for calculating lift, form drag, and moment applicable to thin bodies at small angles-of-attack without separation or with separation at an arbitrary number of given points. The separated flows are related to fully cavitated and partially cavitated flows by making use of the concept of free streamlines. The closure condition of free-streamline theory is replaced by a boundedness condition. Unique solutions are thereby obtained for a large variety of problems. The mathematical solution involves a Riemann–Hilbert mixed-boundary-value problem in an upper-half plane. The general solution for this problem is given in the Appendix and is applied to various kinds of mixed boundary conditions. The method is illustrated by calculations. As may be expected when the boundary profile is truly linear, the solution agrees with the classic exact solution. Author

N64-16473 RAND Corp., Santa Monica, Calif.
HYPERSONIC STRONG VISCOUS INTERACTION ON A FLAT PLATE WITH SURFACE MASS TRANSFER
Ting-Yi Li and Joseph F. Gross Mar. 1963 56 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3000-PR; AD-401339)

An account is presented of the development of an approximation theory for the problem of hypersonic strong viscous interaction on a flat plate with mass transfer at the plate surface. The disturbance-flow region is divided into inviscid- and viscous-flow regions. The hypersonic-small-perturbation theory is applied to the solution of the inviscid-flow region. The method of similar solutions of compressible laminar-boundary-layer equations is applied to the treatment of the viscous-flow region. The pressure and the normal velocity are matched between the inviscid- and viscous-flow solutions. The law of surface mass transfer for similar solutions is derived. Formulas for induced surface pressure, boundary-layer thickness, skin-friction coefficient, and heat-transfer coefficient are obtained. Numerical results and their significance are discussed. Author

N64-16477 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE FLOW OF GAS NEAR THE STAGNATION POINT OF A BLUNT BODY WITH A FINITE RATE OF EXCITATION OF VIBRATIONAL DEGREES OF FREEDOM
I. N. Murzinov 30 Oct. 1962 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 6, 1961 p 33–36
(FTD-TT-62-1313/1+2+4; AD-292197)

Examined is the influence of relaxation caused by excitation of vibrational degrees of freedom of a diatomic gas on flow in the region of the stagnation point of a blunt axisymmetric body moving at supersonic velocity. The approximate solution of the problem is found, and the parameters of the gas near the axis of symmetry between the body and the shock wave are determined. Results are given of the influence of relaxation on the separation of a shock wave as a sphere moves in air, which is considered to be a mixture of molecular oxygen and nitrogen. Author

N64-16617 Mississippi State U., State College
A COMPARISON OF METHODS FOR COMPUTING THE VELOCITY DISTRIBUTION AND THE BOUNDARY LAYER ON BODIES OF REVOLUTION
Ft. Eustis, Va., Army Transportation Res. Command, Nov. 1963 30 p refs
(Contract DA-44-177-AMC-892(T))
(TRECOM-TR-63-47; AD-431277)

This report represents an analytical and experimental study into the solution of flow around a body of revolution. The major consideration is the problem of obtaining the general solutions of the equations of motion. This investigation approached the problem in two parts. The flow outside the boundary layer was assumed to be a perfect fluid and was explored by potential flow methods. The flow inside the boundary layer was explored by boundary-layer methods admitting the predominance of viscosity. Author

N64-16663 Advisory Group for Aeronautical Research and Development, Paris (France)
SURFACE PRESSURE FLUCTUATIONS PRODUCED BY ATTACHED AND SEPARATED SUPERSONIC BOUNDARY LAYERS
Alan L. Kistler Apr. 1963 34 p refs Presented at the AGARD Specialists' Meeting on The Mech. of Noise Generation in Turbulent Flow, Rhode-Saint-Genèse, Belgium, 1–5 Apr. 1963
(AGARD-458)

Measurements have been obtained of the pressure fluctuations on a solid surface immersed in a supersonic stream for Mach numbers up to 5.0. The pressures resulting from both the attached and separated turbulent boundary layers were investigated. The results for the attached layer show that the root mean square value of the pressure fluctuation is proportional to the mean shear stress at the wall, with a proportionality constant that is only weakly dependent on Mach number. The convection velocity characterizing the space–time correlations of pressure on the wall decreases with increasing Mach number, as does the ratio of the scale of the pressure fluctuations to the geometrical boundary layer thickness. The data can be interpreted as showing that the pressure fluctuations originate from two distinct causes, fluctuations due to changes in geometry of the separated region and fluctuations due to the disturbed motion within the separation bubble. Author

N64-16671 Iowa State U. of Science and Tech., Ames
LIFT COEFFICIENTS OF SPHERES MOVING IN CIRCULAR TUBES
Richard A. Hendrickson and Glenn Murphy (M.S. Thesis) Nov. 1963 58 p refs
(Contract W-7405-eng-82)
(IS-615) OTS: $1.50

The effect of viscosity, velocity, and diameter ratio on the lift coefficient of a spherical particle moving in a circular tube was determined experimentally, and a prediction equation for the lift coefficient in terms of these variables was derived. Within the range of particle Reynolds numbers (200 to 550) investigated, the lift coefficient is inversely proportional to viscosity and varies exponentially with the diameter ratio.
Author

N64-16775 Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
PRESSURE AND HEAT TRANSFER MEASUREMENTS FOR HYPERSONIC FLOWS OVER EXPANSION CORNERS AND AHEAD OF RAMPS. PART III: MACH 8 PRESSURE DATA FOR FLOWS AHEAD OF RAMPS
Louis G. Kaufman II Wright-Patterson AFB, Ohio. Flight Control Div., Dec. 1963 140 p refs
(Contract AF 33(616)-8130)
(ASD-TDR-63-679, Pt. 3; AD-428092)

Pressure and heat-transfer data were obtained for hypersonic flows over 40-degree expansion corners and ahead of ramps. Full and partial span ramps, having wedge angles up to 90 degrees, were tested at two locations on a sharp leading-edge flat plate, with and without end plates. Pressure data were obtained for $M_\infty = 5$ for model length Reynolds numbers between 1.1 and 6.6 million. Both pressure and heat-transfer data were obtained for $M_\infty = 8$ for Reynolds numbers between 1.1 and 3.3 million.
Author

N64-16854 General Electric Co., Schenectady, N.Y. Research Lab.
RAREFIED HIGH-TEMPERATURE, ULTRAHIGH MACH NUMBER SLIP FLOW OVER A SHARP FLAT PLATE
H. T. Nagamatsu, R. E. Sheer, Jr., and J. A. Weil Apr. 1963 42 p refs
(Supported in part by Ballistic Systems Div., USAF)
(Rept. 63-RL-(3285C); AD-432130) OTS: $4.60

An investigation was conducted in a hypersonic shock tunnel to determine the induced pressures and the local heat-transfer rates for a flat plate with sharp leading edge. The free-stream Mach number range was 7.95 to 25.1 with stagnation temperatures of approximately 2,300° and 7,000° R. For these temperatures and Mach number conditions, the strong interaction parameter, $\chi = M_1{}^3/\sqrt{Re_x}$, varied from 2.35 to 826, and the corresponding Knudsen numbers, based on the ratio of the free stream mean free path and the leading-edge thickness, varied from 0.4 to 86. For free-stream Mach numbers greater than 10, Knudsen numbers of approximately unity, and perfect gas conditions, the observed experimental induced pressures varied as $\chi^{-1/2}$ and the local heat-transfer rates varied as $\chi^{-3/4}$, as predicted by the noninsulated flat-plate theory of Li and Nagamatsu. For the case of $Kn_1 >> 1$ and $M_1 >> 1$, the leading-edge slip phenomenon drastically reduced both the induced pressures and the local heat-transfer rates, as compared to the theoretical values predicted with no slip at the surface.
Author

N64-16856 General Dynamics/Astronautics, San Diego, Calif.
LOW-DENSITY HYPERSONIC NOZZLES WITH CRYOGENIC PUMPING TO CONTROL THE VISCOUS EFFECTS
B. M. Leadon, G. T. Rayfield, and W. H. Gallaher Nov. 1963 48 p refs
(Sponsored by REA 111-9558)
(ERR-AN-349; GD/A 63-1090)

Pitot pressure surveys are made of the low-density hypersonic gas flows from each of two conical nozzles to determine the effects of cryogenic pumping on the boundary layers. Carbon dioxide was chosen as the test gas because of the availability of liquid nitrogen as the cryogenic liquid. The normally thick nozzle boundary layers were found to be greatly reduced by cryogenic pumping in both cases. Cryogenic pumping of a high-speed, laminar boundary layer having thus been shown to be very effective, plans were made to use this type of pumping to control boundary-layer separation at a compression corner. The model prepared for this experiment is described.
Author

N64-16872 Grumman Aircraft Engineering Corp., Bethpage, N.Y.
PRESSURE MEASUREMENTS FOR MACH 8 FLOWS OVER EXPANSION CORNERS AND RAMPS ON AN INTERNALLY COOLED MODEL. PART I: EXPANSION CORNER FLOWS
Part of an Investigation of Hypersonic Flow Separation and Control Characteristics
Louis G. Kaufman II Wright-Patterson AFB, Ohio. Flight Control Div., Oct. 1963 73 p refs
(Contract AF 33(616)-8130)
(RTD-TDR-63-4044, Pt. 1; AD-431280)

Pressure distributions were obtained for Mach 8 flows over a sharp 40° expansion corner and ahead of ramps on an internally cooled model. Full and partial span ramps, having wedge angles up to 30°, were tested at model angles-of-attack from −45° to +10° for Reynolds numbers ranging from 1.1 to 3.3 million. The model wall temperature was maintained at fairly constant levels ranging from 450° to 1,150°R.
Author

N64-16878 Aro, Inc., Arnold Air Force Station, Tenn.
EQUATIONS AND CHARTS FOR THE EVALUATION OF THE HYPERSONIC AERODYNAMIC CHARACTERISTICS OF LIFTING CONFIGURATIONS BY THE NEWTONIAN THEORY
E. L. Clark and L. L. Trimmer Arnold Eng. Develop. Center, Mar. 1964 91 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-25; AD-431848)

The pressure distribution predicted by the modified Newtonian theory is used to develop equations for the aerodynamic forces, moments, and stability derivatives for components of hypersonic lifting configurations. In conjunction with the equations, a set of charts is presented to enable simple determination of the aerodynamic characteristics of swept cylinders, swept wedges, spherical segments, and cone frustums at zero sideslip and angles-of-attack from 0° to 180°. This method allows evaluation of most delta wing-body combinations without the need for numerical or graphical integration.
Author

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N64-16204 Saarland U., Saarbrucken (W. Germany)
A CONTRIBUTION TO THE AERODYNAMICS OF AN OSCILLATING CASCADE, PART III (SUBSONIC FLOW) [BEITRAG ZUR AERODYNAMIK EINES SCHWINGENDEN GITTERS III (UNTERSCHALLSTROMUNG)]
Von E. Meister Porz-Wahn, W. Germany, Deut. Versuchsanstalt für Luft- und Raumfahrt, 1962 Repr. from Z. Angew Math. Mech., (Berlin), v. 42, no. 6, 1962 p 245–254 refs In GERMAN, ENGLISH summary
(Contract DA-91-591-EUC-1739)
(DVL-248)

Perturbation velocity field and lift distribution are computed for the case of a vertical cascade with line profiles reaching to infinity in the flow direction. Neighboring blades are assumed to oscillate with the same phase but with arbitrary upwash distribution. The medium is assumed to be compressible and inviscid and the flow to be parallel to the blades in their mean position, with a Mach number $M < 1$. Author

N64-16478 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PHENOMENA TAKING PLACE IN TURBINE BLADE GRIDS AND CORRECT DEVELOPMENT OF PROFILE
Istvan Erdody (Leningrad Polytech. Inst.) 9 May 1963 14 p Transl. into ENGLISH from Energie Atomtech. (Budapest), no. 8, 1962 p 337–342
(FTD-TT-63-133/1+2+3+4; AD-414757)

An investigation was made of the value of using the cylindrical-profile blading system for determining the aerodynamic profiles of the last stages of turbines that have blades measuring from 700 to 1000 mm. R.T.K.

N64-16862 Grumman Aircraft Engineering Corp., Bethpage, N.Y.
EXPERIMENTAL STUDY OF HIGH SPEED HYDROFOILS, VOLUME II, PART IV
H. R. Wright 26 Aug. 1963 157 p
(Contract 84454)
(XAR-A-45)

This test program was conducted to measure the hydrodynamic characteristics of a series of transcavitating and supercavitating hydrofoil models with various planforms and sections to provide a design procedure to predict hydrodynamic characteristics for this type hydrofoil. Twenty hydrofoil models were tested in the Grumman whirling tank at three depths and at a sufficient number of speeds and angles-of-attack to fully define their hydrodynamic characteristics. Lift, drag, pitching moment, and strut base pressure were measured for all models, and cavity pressure and foil pressure were measured for the supercavitating models. Classic supercavitating hydrofoil theory is shown to predict test results with an accuracy adequate for design if a modified value for the cross-flow lift coefficient is accepted. Author

04 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc., and specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; safety devices; and stability and control. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N64-16290 Federal Aviation Agency, Atlantic City, N.J. Systems Research and Development Service
AN EVALUATION OF THE EFFECTS OF ALTITUDE ON THE HEIGHT VELOCITY DIAGRAM OF A SINGLE ENGINE HELICOPTER
William J. Hanley and Gilbert De Vore Washington, Federal Aviation Agency, Feb. 1964 83 p refs
(FAA-ADS-1)

A series of flight tests were conducted at four selected altitudes (sea level, 4,000 ft, 7,000 ft, and 10,000 ft) to determine the effects of altitude on the height–velocity (H–V) diagram of a lightweight, single-rotor, single-engine helicopter. Three gross weights of the helicopter were used. Quantitative and qualitative test data were collected to determine how the height–velocity diagram varies with density altitude. Results disclosed a family of curves showing that increases in either density altitude or gross weight increased either the airspeed or the height above the ground that was required for a safe autorotation landing. Analysis of the results led to the derivation of three linear equations that expressed the relationship of critical points of the height–velocity diagram of the test helicopter for various gross weights and density altitudes. Author

N64-16292 Advisory Group for Aeronautical Research and Development, Paris (France)
LOW-ALTITUDE, HIGH-SPEED HANDLING AND RIDING QUALITIES
Ralph C. A'Harrah Apr. 1963 51 p refs Presented at the 22nd Meeting of the Flight Mech. Panel, Torino, Italy, 16–19 Apr. 1963
(AGARD-443)

The results of a combined flight- and ground-based dynamic flight simulator study of the handling and riding qualities problems associated with low-altitude, high-speed flight are presented. Wide variations of the longitudinal stability and control characteristics, which can be considered representative of current and future strike aircraft, were pilot evaluated. The influence of these stability and control characteristics and the effects of low-altitude turbulence on the pilots' terrain-following performance were measured. Combinations of vehicle and control system characteristics that tend to become unstable when coupled with the pilots' response (i.e., pilot-induced oscillations) have been defined. Author

N64-16298 Advisory Group for Aeronautical Research and Development, Paris (France)
A SUPERSONIC PARACHUTE BASED ON THE INLET DIFFUSER CONCEPT
Helmut G. Heinrich Apr. 1963 39 p refs Presented at the 22nd Meeting of the Flight Mech. Panel, Torino, Italy, 16–19 Apr. 1963
(AGARD-445)

Several aerodynamic principles are postulated and explored which in connection with a related combination of a solid cone and a flexible canopy lead to the development of an aerodynamic decelerator, called the Supersonic Guide Surface Parachute. Author

N64-16387 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PERSPECTIVES OF THE DEVELOPMENT OF AVIATION
2 Oct. 1963 6 p Transl. into ENGLISH from Skrzydl. Polska (Warsaw), no. 17(616), 1963 8 p
(FTD-TT-63-788/1; AD-423211)

A brief discussion is presented in which an attempt is made to answer the following questions: (1) Are there inherent

ceilings and speed limits for aircraft? (2) What is a hypersonic aircraft? (3) What hindrances of the "sonic barrier" type will aviation encounter as it is developed further? (4) On what will the duration of an aircraft flight depend in the future? P.V.E.

N64-16426 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HIGH-ALTITUDE PROBING OF THE ATMOSPHERE ON THE IL-28 AIRPLANE
V. A. Devyatova 18 Jul. 1963 18 p refs Transl. into ENGLISH from a Russian book "Trudy Tsentral'noy Aerologicheskoy Observatorii" Moscow, Gidrometeoizdat, no. 43, 1962 p 47–56
(FTD-TT-63-534/1+2; AD-415017)

The equipment of the high altitude probing aircraft IL-28, its system of flying, the observations made during flight, and the automatic tape recording unit located in the cabin, are described. R.T.K.

N64-16469 David Taylor Model Basin, Washington, D.C. Aerodynamics Lab.
WIND TUNNEL INVESTIGATION OF LAUNCH TRAJECTORIES OF THE BEECH XKD2B-1 TARGET DRONE WHEN LAUNCHED FROM THE F3H-2 AIRPLANE
Henry S. Ozarko Dec. 1963 106 p refs
(DTMB-AERO-993; AD-430438)

An investigation was performed in the 7- by 10-foot Transonic Wind Tunnel to predict the trajectory characteristics of the Beech XKD2B-1 target drone following launch from the F3H-2 airplane. A series of 23 trajectories were predicted for launch conditions at several Mach numbers and altitudes with various pylon configurations. Aileron response was assumed to be in accordance with drone autopilot operation, except for one trajectory in each group, which was also computed for ailerons fixed. Author

N64-16487 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
LABORATORY TESTING OF MODEL 568T1 HELICOPTER AIRSPEED SYSTEMS
E. T. Skelly 28 Sep. 1962 39 p refs
(Contract NOa(s)-60-0194-c)
(CAL-IH-1470-F-1; AD-430833)

Laboratory testing of five Model 568T1 helicopter airspeed systems shows that they are capable of measuring helicopter true airspeed over the operating speed range of the helicopter. The system is substantially electrical and is based on the continuous measurement of the variation in a rotor blade tip speed relative to the surrounding air. The variation in blade tip speed is measured and utilized to simultaneously present true airspeed on two airspeed indicators, one indicating true airspeed along the longitudinal axis of the helicopter and the other indicating true airspeed along the lateral axis of the helicopter. Author

N64-16488 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
HELICOPTER TRUE AIRSPEED SYSTEM MODEL 568T1 Final Report
E. T. Skelly 28 Sep. 1962 42 p refs
(Contract NOa(s)-60-0194-c)
(CAL-IH-1470-F-3; AD-430771)

The Model 568T1 helicopter airspeed system described is capable of measuring the longitudinal and lateral components of the true airspeed over the entire airspeed range of the helicopter. Each one of five airspeed systems being supplied is mechanically designed and electrically adjusted for use on a specific type of helicopter—types HSS-1, HSS-2, HU2K, or HUP3. For flight operation, the estimated accuracy of the system based on design considerations and results of laboratory tests is ±2 knots or 2% of the indicated reading, whichever is greater. Author

N64-16530 Aeronautical Research Council (Gt. Brit.)
FREE-FLIGHT MODEL DRAG MEASUREMENTS ON A TRANSONIC FIGHTER (GLOSTER JAVELIN)
G. H. Greenwood London, HMSO, 1964 28 p refs
(ARC-CP-678; previously issued as RAE-TN-AERO-2594; ARC-20997) HMSO: 5s

Zero-lift drag measurements were made on a series of wings proposed for development of the Javelin. A comparison is made between the performance of the Mk.I wing (t/c = 0.10), the proposed wing (t/c = 0.07), and two wings having varying thickness-chord ratios and high rates of spanwise thickness taper near the root. Models of the complete aircraft were also tested to investigate the reductions in drag obtained by a limited application of the area rule. Author

N64-16538 Advisory Group for Aeronautical Research and Development, Paris (France)
NASA VARIABLE-GEOMETRY RESEARCH
T. A. Toll, E. C. Polhamus, and W. S. Aiken, Jr. (NASA) Apr. 1963 20 p FRENCH summary
(AGARD-447)

The past, present, and probable future research activities of NASA with respect to applications of variable geometry are outlined. A general discussion is given of the reasons for considering variable geometry. Past developments are summarized to show how they have resulted in increased operational flexibility of aircraft. Emphasis is placed on the variable-sweep program. The historical aspects and objectives of this activity are described briefly. The various approaches that have been investigated, along with some of their advantages, are described. The scope of the NASA program with respect to configurations, mission studies, structures, mechanisms, flutter, and piloting problems is outlined. Author

N64-16662 Advisory Group for Aeronautical Research and Development, Paris (France)
AIRCRAFT TESTS IN HIGH-SPEED LOW-LEVEL FLIGHT, INCLUDING IMPRESSIONS OF A SPRING-MOUNTED SEAT
T. H. Kerr, J. E. Nethaway, and H. W. Chinn (RAE) Apr. 1963 40 p refs Presented at the 22nd Meeting of the Flight Mech. Panel, Torino, Italy, 16–19 Apr. 1963
(AGARD-442)

An investigation of terrain-following flying at high speeds on a Hunter aircraft is described, and examples are given of the flight paths achieved and the normal accelerations developed. Fatigue meter data are used to provide a measure of flight bumpiness and to show good correlation with pilots' opinions. The possible effects of aircraft structural vibrations on crew comfort are considered, and results are given of tests made on a Canberra aircraft to assess the usefulness of a spring-mounted seat, for a range of frequencies and damping; a marked improvement in comfort was found with certain spring characteristics. Impressions of comfort on both aircraft correlate well with the RMS of rate of change of acceleration. Author

N64-16742* Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
STATE DETERMINATION FOR A FLEXIBLE VEHICLE WITHOUT A MODE SHAPE REQUIREMENT. ROCKET BOOSTER CONTROL, SECTION 12

E. E. Fisher 28 Jan. 1964 9 p ref
(NASA Contract NASw-563)
(NASA-CR-53099; MH-MPG-1541-TR-12) OTS: $1.10 ph, $0.80 mf

A problem involving state determination for a flexible vehicle, without known mode shapes, is considered. Conditions are established that allow a least-squares estimate of certain system parameters. Results show that it is possible, given a controllable plant with a nonlinear controller and time histories of n functions z_i that depend on the state components x_i through a nonsingular linear transformation, to establish the matrix of the transformation by the method of least squares. This demonstration establishes, for the flexible-vehicle problem, the possibility of an "adaptive system" that is capable of state determination without complete knowledge of the mode shapes. I.v.L.

N64-16851 Rensselaer Polytechnic Inst., Troy, N.Y.
THE EFFECT OF SIMULATED HIGH FORWARD SPEED ON A TWO-DIMENSIONAL GROUND EFFECT SUPPORT
Anthony A. West Oct. 1963 39 p refs
(Contract DA-ORD-31-124-61-G88)
(AROD-2566-6; TR-AE-6304; AD-426469) OTS: $3.60

Preliminary tests have been conducted to investigate the feasibility of using ground effect supports to provide suspension and propulsion of a vehicle at high forward speeds. The effects of simulated high forward speeds on the lift and drag of a two-dimensional ground effect support are correlated through a forward-speed parameter that is derived in this report. Author

05 ASTRONOMY AND ASTROPHYSICS

Includes celestial mechanics; and radioastronomy. *For related information see*: 12 Geophysics, and 29 Space Sciences.

N64-16209 Turku U. (Finland) Astronomia-Optika Institucio
POLE HEIGHT OBSERVATIONS WITH THE NEW ZENITH TELESCOPE OF TURKUTUORLA OBSERVATORY [POLHOHENBEOBACHTUNGEN MIT DEM NEUEN ZENITROHR DER STERNWARTE TURKU-TUORLA]
Y. Vaisala and L. Oterma 1963 49 p refs In GERMAN
Uts Informo 27; Ann. Acad. Sci. Fennicae: Ser. A III, no. 71 (Helsinki))

The large zenith telescope was used for routine pole-height observations of zenith-near stars to investigate the change in latitude, and for horizon observations to determine the declinations of these stars. The results of these observations, which were conducted since the fall of 1960, are presented in tabular form. The zenith telescope is described, and the various observation methods employed are discussed. I.v.L.

N64-16215* California U., La Jolla
METEORITES [METEORITER]
Kurt Fredriksson and Frans E. Wickman Repr. from Svensk Naturvetenskap, 1963 p 121–157 In SWEDISH
(NASA Grant NsG-317-63)
(NASA CR-55368)

The scheme of meteoritic falls, including total destruction, dust trails, breakup, region of retardation, explosion, craters, and settling of meteoritic dust, is described. Map locations of selected meteoritic craters, both for the world and for Sweden, microphotographs of meteroritic materials, and photographs comparing tektites with ablated glass models, are given. P.F.E.

N64-16288 Joint Publications Research Service, Washington, D.C.
SOME RESULTS OF OBSERVATIONS WITH ELECTRON TELESCOPES
P. V. Shcheglov 9 Mar. 1964 48 p Transl. into ENGLISH of Chapter 13 of "Elektronnaya Teleskopiya", Moscow, State Publ. House for Physico-Math. Literature, 1963 p 157–192
(JPRS-23570; OTS-64-21739) OTS: $1.75

The following are described: (1) the use of an infrared-sensitive electron-optical converter with photographic recording for studying the region of the galactic center; (2) efforts in obtaining photographic cross sections in the region of the galactic center with the aid of equipment that is sensitive in the infrared region of the spectrum, and the detection of a glow in certain regions where observations under visible light did not detect any such increased intensity; (3) photographic observations of the stellar clouds in the Sagittarius constellation; (4) the differences in interstellar absorption in different regions of the galaxy; (5) the central bulge of the galaxy; (6) spectral photography of the night sky in the infrared range; (7) the infrared radiation of hydroxyl; (8) the emission of helium by the northern lights; (9) the emission of the oxygen line in the upper atmosphere; (10) the fluorescence of the upper atmosphere caused by solar radiation; (11) models of the geocorona; (12) the galactic nuclei; (13) the observation of artificial celestial bodies with the aid of image converters; and (14) instantaneous photographing of planets with the aid of contact converters. R.T.K.

N64-16362 Air Force Systems Command, Wright-Patterson AFB, Ohio
VOLCANOES ON VENUS
N. A. Kozyrev 29 Mar. 1963 4 p Transl. into ENGLISH from Zarya Vostoka (USSR), 18 Dec. 1962 p 4
(FTD-TT-63-305/1+4; AD-402594)

Photographs of the absorption spectra of the smoke flames from certain active volcanoes of the Klyuchevskiy group at Kamchatka were obtained. These photographs revealed the presence of two absorption bands in the visible region of the spectrum. Bands of this same type had been previously observed in the spectrum of Venus. Thus, the existence of such bands in the spectra of volcanic fumes provides a basis for assuming that there is strongly developed volcanic activity on Venus. These bands are entirely absent in the Martian atmosphere; therefore, there is a basis for assuming that volcanic activity on this planet, if it does exist, is significantly weaker than that on Venus and Earth. I.v.L.

N64-16443 Army Map Service, Washington, D.C. Corps of Engineers
TOPOGRAPHIC LUNAR MAP [LUNAR NAMES LISTING]
Washington, Govt. Print. Off., 1963 2 p Edition 1-AMS
Available from GPO: $1.00

A 1:5,000,000 topographic lunar map (relief style) is presented along with a listing of all named features occurring in each 1° area. Only the western half of the lunar surface is shown. P.V.E.

N64-16492 Liege U. (Belgium)
RECENT PROGRESS IN COMETARY SPECTROSCOPY Technical Note No. 5

P. Swings 20 Nov. 1963 23 p refs
(Contract AF 61(052)-587)
(AFCRL-64-227; AD-430639)

Great progress in cometary physics has been made recently, especially by applying a higher spectral and geometrical resolution. The new observational results are described. The report concentrates on recent progress in the understanding of excitation mechanisms in the case of diatomic and triatomic radicals and ions. Author

N64-16558 International Scientific Radio Union (URSI), Brussels (Belgium) United States Commission V
REVIEW OF DEVELOPMENT OCCURRING WITHIN THE UNITED STATES OF AMERICA IN THE FIELD OF RADIO AND RADAR ASTRONOMY; 1960-1963
A. E. Lilley (Harvard Coll. Obs.) [1963] 90 p refs

Research included the development of new equipment and new techniques in the study of solar, lunar, and planetary phenomena. Investigations covered precise determinations of the mean total of atmospheric refraction; studies of discrete radio sources; long-wave radiofrequency studies of the planets; observations of solar radio bursts; regular surveys of meteor activity; the use of radio telescope for celestial mapping; studies of the microwave spectrum of planetary atmospheres; and the monitoring of solar and galactic radiation. C.L.W.

N64-16678* Princeton U. Observatory, N.J.
MARS OBSERVATIONS FROM STRATOSCOPE II
R. E. Danielson, J. E. Gaustad, M. Schwarzschild, H. F. Weaver, and N. J. Woolf (Calif. U.) Repr. from Symp. on Instrumental Astronomy, Ariz. U., 1964 refs
(Sponsored by NASA, NSF, and ONR; Proj. Stratoscope)

On March 1, 1963, Stratoscope II, a balloon-borne telescope, was flown for the first time with the aim of investigating the infrared spectrum of Mars. A series of technical difficulties arose during the flight and severely restricted the number and quality of the spectrometer scans that were obtained. Nevertheless, the following results could be deduced from these scans: (1) It is improbable that the water vapor content of Mars is greater than 40 microns. (2) If the total pressure at the surface of Mars is assumed to be 87 mb, the amount of CO_2 in the atmosphere of Mars amounts to about 6,000 cm-atm, rather than 3,000 cm-atm, as previously estimated. Author

N64-16723* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ON THE LUMINOUS EFFICIENCY OF METEORS Research in Space Science
Franco Verniani 17 Feb. 1964 66 p refs
(NASA Grant NsG-87-60)
(NASA CR-55904; SAO Special Rept. 145) OTS: $6.60 ph, $2.18 mf

The ratio of the photographic luminous efficiency τ_p to the square of the density ρ_m of meteors has been computed directly from observational data. It is possible to determine τ_p only in the few cases in which the meteors show positive evidence of asteroid origin. The dependence τ_p pn v is found, and it is shown that a power law $\tau_p = \tau_{op}\, v^n$ best represents τ_p as a function of v. The analysis shows no dependence of τ_p on mass or brightness and fails to detect any change of τ_p in the course of a meteor trajectory. It is also independent of atmospheric density. Luminous efficiency does depend, however, on fragmentation, in the sense that nonfragmenting meteors produce light more efficiently than those that crumble easily. E.W.

N64-16730* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE EVOLUTION OF MASSIVE STARS. PART III. HYDROGEN EXHAUSTION THROUGH THE ONSET OF CARBON BURNING
Chushiro Hayashi (Kyoto U.) and Robert C. Cameron Washington, NASA Dec. 1962 44 p refs (See N62-16859 17-28)
(NASA-TR-R-144) OTS: $1.25

Computations are made for the evolution of a population I star of 15.6 solar masses and an age-zero composition of hydrogen concentration x = 0.90, helium concentration Y = 0.08, and the concentration of the remaining elements Z = 0.02, through four phases: (1) hydrogen exhaustion in the convective core; (2) gravitational contraction of the core; (3) helium burning; (4) the onset of carbon burning; and (5) the onset of neon burning in the absence of a preceding carbon burning phase. This discussion builds upon the model treated by Sakashita, Ono, and Hayashi. It is assumed there is no mass loss from the stellar surface, no mixing except in the convective core, and the opacity of the star is due entirely to electron scattering. Radiation pressure is taken fully into account. Author

N64-16733* Mellon Inst., Pittsburgh, Pa.
FOSSIL GLASSES PRODUCED BY IMPACT OF METEORITES AND ASTEROIDS WITH THE PLANET EARTH
A. J. Cohen Repr. from the book "Advances in Glass Technology, Part 2" N.Y., Plenum Press, 1963 p 360-375 refs
(NASA Grant NsG-57-60)

Fossil glasses produced by the impact of meteorites and asteroids, or possibly by comet impact, are reviewed. These glasses, known as tektites, differ in general from volcanic glasses in that they are lower in water content, have lower gallium and germanium contents, and are not necessarily in magnetically unstable continental areas. This report discusses the following types of fossil glasses and where they are found: (1) glasses found in or near terrestrial meteorite craters—these glasses usually contain numerous spherules of nickel-iron, coesite, chunks of partially melted meteoritic matter, and even stishovite; quartz is commonly present; (2) glasses associated with craters with no evidence of meteoritic material in the glass or surrounding explosion site; (3) glasses containing little or no aerodynamic shaping and not associated with any known crater—these glasses usually contain some unmelted fractured quartz, coesite, and high-melting detrital minerals; and (4) green to brown glasses, aerodynamically shaped—these glasses contain only silica-glass and nickel-iron spherules as inclusions. I.v.L.

N64-16758* RAND Corp., Santa Monica, Calif.
THE PHYSICAL EPHEMERIS OF MARS
G. de Vaucouleurs Jan. 1964 24 p refs
(NASA Contract NASr-21(04))
(NASA CR-53117; RM-3999-NASA) OTS: $2.60 ph, $0.92 mf

A revision of the physical ephemeris of Mars is one of the first steps toward a reasonably accurate Martian map. The complexities in determining true values are pointed out, and a set of values is found that serves as the basis for computing the new ephemeris. Author

N64-16765* RAND Corp., Santa Monica, Calif.
SOURCES OF AREOGRAPHIC COORDINATES, 1877-1907
G. de Vaucouleurs and R. Wright Jan. 1964 73 p refs
(NASA Contract NASr-21(04))
(NASA CR-53064; RM-3991-NASA) OTS: $7.60 ph, $2.39 mf

All published areographic coordinates for the oppositions of 1877 through 1907 were checked, corrected, and cross identified after a thorough search for usable data in the literature. Altogether, 380 points on Mars' surface recorded by 17 observers are listed, with notes on errors of measurement or identification in the original sources; individual observer's maps and a basic master map are given. Author

N64-16768* Smithsonian Astrophysical Observatory, Cambridge, Mass.
CONSTRUCTION OF NEWCOMB OPERATORS ON A DIGITAL COMPUTER
I. G. Izsak, J. M. Gerard, R. Efimba, and M. P. Barnett 24 Jan. 1964 97 p refs
(NASA Grant NsG 87-60)
(NASA CR-55844; SAO Special Rept. 140) OTS: $8.60 ph, $3.11 mf

A brief exposition is given of the development of the planetary disturbing (perturbative) function that was adopted as based on the use of Newcomb operators, and a generalization is presented of the Newcomb operators that were introduced in connection with the problem of near-commensurabilities in the restricted three-body problem. A program is described that was used on the IBM 709 to produce Newcomb operators, relating to the mean anomaly of the inner planet to the 12th degree in the orbital eccentricity. Also, results (Newcomb operators) in polynomial form, obtained by means of a photocomposition technique, are presented. I.v.L.

N64-16772* Mellon Inst., Pittsburgh, Pa.
ASTEROID-IMPACT HYPOTHESIS OF TEKTITE ORIGIN III. THE SOUTHEAST ASIAN STREWN FIELDS
Alvin J. Cohen Repr. from Space Research III: Proc. 3d Intern. Space Sci. Symp., 1963 p 950–973 refs RUSSIAN Summary Presented in Washington, 30 Apr.–9 May 1962
(NASA Grant NsG-57-60, Suppl. 1-62)

In earlier presentations, other tektite strewn field areas were discussed in detail from the geochemical standpoint. In this paper, a portion of the youngest, circa 600,000 years, tektite complex is discussed. The occurrence of tektites of the same age lying in strewn fields arranged in opposing geographical directions makes a nonterrestrial origin for tektites untenable. The necessary work needed to prove this hypothesis is outlined. Author

N64-16779 Library of Congress, Washington, D.C. Aerospace Information Div.
RADIO ASTRONOMY ANTENNAS AND PROCESSING OF RADIO ASTRONOMY DATA ANNOTATED BIBLIOGRAPHY OF SOVIET LITERATURE (PRELIMINARY), 1958–Feb. 1963
4 Mar. 1964 45 p refs
(AID B-64-11; AD-431787) OTS: $4.60 ph, $1.55 mf

The bibliography is broken down into parts by year of publication, and alphabetically by author within the parts. An author index is included. E.W.

06 AUXILIARY SYSTEMS

Includes fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters. *For primary propulsion systems see*: 27 Propulsion. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-16116* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF THE CALORIMETRIC EFFICIENCY OF A SPLIT-RIB UMBRELLA-TYPE PARABOLOIDAL SOLAR ENERGY CONCENTRATOR
John D. Camp and William D Nowlin Washington, NASA, Mar. 1964 25 p refs
(NASA TN D-2015) OTS: $0.75

An investigation of the calorimetric efficiency of a 10-ft-diam. splitrib umbrella-type paraboloidal solar energy concentrator was performed. Calorimetric tests employed three spherical calorimeters with 3-in., 6.25-in., and 12-in. diameters. The variation in the geometrical efficiency with the diameter ratio is shown, and comparison with a previously tested 60-rib concentrator is made. Maximum geometrical efficiencies obtained were 100, 81, and 40 percent with the 12-in.-, 6.25-in.-, and 3-in.-diam. calorimeters, respectively. The experimentally obtained efficiencies are compared with theoretical values. This investigation demonstrated that attempts to improve the efficiency of an umbrella-type concentrator by increasing the number of ribs result in improvements that are small in comparison to those that could be effected by simultaneously reducing the stress-geometry parameter. Author

N64-16202 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (W Germany) Inst. für Strahlantriebe
ELECTRIC PROPULSION AND CONTROL SYSTEMS FOR A 24-HOUR SATELLITE [ELEKTRISCHE ANTRIEBS- UND STEUERUNGSSYSTEME FUR 24-STUNDEN-SATELLITEN]
Gunther F. Au Repr. from Raketentech. Raumfahrtforsch., no. 1, Jan.–Mar. 1963 Presented at the 14th Anniv. of the DGRR, Brunswick, 20–23 Jun. 1962 In GERMAN, ENGLISH summary 14 p
(DFL-205)

This study presents a discussion of problems related to orbit transfer of satellites under optimal conditions from a 200-km circular orbit to the 24-hr equatorial orbit. The electric propulsion and control systems suitable for such a mission are described. A comparison is made between the electric propulsion system and a chemical propulsion system. The electric propulsion system is found to be superior, due to the much shorter transfer time. Author

N64-16256 Atomics International, Canoga Park, Calif.
MULTIPLE-UNIT SNAP 2 POWER SYSTEMS FOR MANNED APPLICATION
H. N. Rosenberg, ed. 28 Jan. 1964 85 p
(Contract AT(11-1)-GEN-8)
(NAA-SR-9252) OTS: $2.45

A study has been made of the feasibility of utilizing multiple-unit SNAP 2 systems to provide power in the 10- to 40-kwe range for manned space stations. Principal areas of investigation have been reliability, packaging, weight, and operational considerations. It is concluded that multiple-unit systems are entirely feasible and within the state-of-the-art represented by the present SNAP 2 system. The multiple-unit SNAP 2 appears to be the most logical choice for early application of nuclear power to manned space stations. Author

N64-16267* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio
BRAYTON CYCLE CAVITY RECEIVER DEVELOPMENT Quarterly Report, Oct. 1963–Dec. 1963
[1964] 21 p
(NASA CR-55734; ER-5736) OTS: $2.60 ph, $0.83 mf

A summary of the current program includes: (1) The preliminary design analysis for a cavity receiver intended to operate

in a single orbit was completed. (2) The activity on the full-scale flightweight design has been concentrated on the review of three potential full-scale concepts and the selection of the optimum concept. (3) The investigation on lithium fluoride properties was completed. (4) The cavity surface temperature control and aperture closure study is in process. (5) The 20 capsules required for the first 2,500-hr furnace test were fabricated, loaded with lithium fluoride, and sealed. They were mounted in the test container, which was then sealed and inserted in the furnace. The capsules accumulated 672 hours of testing. The average heating cycle was 1.0 hr. The average cooling cycle was 0.515 hr. The temperature limits were 1,500° and 1,850° F. When the capsule container was removed from the furnace after cool-down, it was noted that about one-eighth of the container had been completely destroyed. I.v.L.

N64-16268* Livingston Electronic Corp., Montgomeryville, Pa.
DEVELOPMENT OF HIGH ENERGY DENSITY PRIMARY BATTERIES, 200 WATT HOURS PER POUND OF TOTAL BATTERY WEIGHT MINIMUM Second Quarterly Report, 19 Aug.–19 Nov. 1963
W. F. Meyers [1963] 100 p refs
(NASA Contract NAS3-2775)
(NASA CR-55743) OTS: $8.60 ph, $3.20 mf

The current program status includes: (1) A solvent-orientated battery energy equation was developed. This equation is a useful tool for selecting electrolytes for high-energy-density battery testing. A figure of merit, based upon watt hours per pound, has been evolved that should be sufficiently accurate for screening useful solvents for further study. (2) The theoretical study of electrodes has begun. (3) The concept of using atmospheres, other than air, to provide improved electrolyte conductivity has been verified by experiment. (4) The automatic recording of data for electrolyte-atmosphere systems is in progress. These data are being evaluated by means of the theoretical equation concerning the solvent. The great quantities of information issuing from the recorder indicate that this method of collecting data will make the study of many new battery electrolytes practical. I.v.L.

N64-16270* General Electric Co., Schenectady, N.Y. Advanced Tech. Labs.
CHARACTERIZATION OF NICKEL-CADMIUM ELECTRODES First Quarterly Report, 1 Jul. 1963–1 Oct. 1963
[1963] 29 p
(NASA Contract NAS5-3477)
(NASA CR-55772) OTS: $2.60 ph, $1.07 mf

A method of analysis and characterization of the electrodes used in nickel–cadmium sealed cells is being developed. The work during the first quarter was largely of a preparative nature. It involved the design and construction of the extensive control and testing equipment required for conducting the characterization and cyclic tests; design and construction of test cell holders; and the preparation of electrodes for the test program. Author

N64-16271* Goodyear Aerospace Corp., Akron, Ohio Space Systems Div.
RIGIDIZED INFLATABLE SOLAR ENERGY CONCENTRATORS First Quarterly Progress Report, 30 Sep. 1963–31 Dec. 1963
N. Jouriles and C. E. Welling 15 Jan. 1964 44 p refs
(NASA Contract NAS1-3301)
(NASA CR-55798; GER-11438) OTS: $4.60 ph, $1.52 mf

The major areas of investigation include: (1) a review of heat-activated material formulations; (2) selection of azides for evaluation; (3) construction of test apparatus; and (4) an investigation of reactions resulting from the blending of various materials. The approach taken, the choice of materials, the measurements of experimental values, the materials under study, and the direction of future work are discussed. The azotometer analysis, the measurement of heat release from azide rearrangement, and the sublimation test are described in detail. Author

N64-16273* Eagle-Picher Co., Joplin, Mo. Couples Dept.
DESIGN AND DEVELOPMENT OF SILVER-CADMIUM STORAGE BATTERIES Third Quarterly Report, 1 Jan.–31 Mar. 1962
[1962] 33 p
(NASA Contract NAS5-1318)
(NASA CR-55633) OTS: $3.60 ph, $1.19 mf

Cell-material development, fabrication procedures, formation techniques, cycle testing, and dynamic testing are discussed along with the performance of the silver–cadmium couple. Highlights of the report period include the following: (1) Cyclic testing of cells fabricated from unformed active materials was initiated. (2) Cyclic testing of a 10-cell battery at 20° ±2° F was initiated and has completed 910 cycles. (3) Cyclic testing of a 10-cell battery at 120° ±2° F was terminated after 624 cycles, due to a complete breakdown in separation. (4) Three "D" cells completed 1,797 cycles at a depth of discharge of 10%. (5) The magnetic properties of all test cells were minimized through the selection of applicable components. (6) Single cells were subjected to limited dynamic testing. P.V.E.

N64-16274* Allis-Chalmers Mfg. Co., Milwaukee, Wis. Research Div.
RESEARCH AND DEVELOPMENT OF AN OPEN-CYCLE FUEL CELL SYSTEM Third Quarterly Report, 1 Jan. 1963–31 Mar. 1963
R. Opperthauser, D. Ghere, J. Platner, J. Euclide, and J. Rubenzer [1963] 52 p
(NASA Contract NAS8-2696)
(NASA CR-55778) OTS: $5.60 ph, $1.76 mf

Theoretical and experimental studies have been directed toward the development of the Vapor Pressure Control technique for the removal of byproduct water from hydrogen–oxygen fuel cells. Investigations of cell performance over extended periods of time were made on single cell units using the gas chromatograph and on multicell modules. Initial tests on various major components necessary to operate and control a breadboard system utilizing Vapor Pressure Control and recirculated reactants are reported. Author

N64-16275* Allis-Chalmers Mfg. Co., Milwaukee, Wis. Research Div.
RESEARCH AND DEVELOPMENT OF AN OPEN-CYCLE FUEL CELL SYSTEM Sixth Quarterly Report, 1 Oct.–31 Dec. 1963
J. Euclide, R. Opperthauser, C. Pax, D. Ghere, and B. Nichols 31 Jan. 1964 28 p
(NASA Contract NAS8-2696)
(NASA CR-55799) OTS: $2.60 ph, $1.04 mf

A program for studying Static Vapor Pressure Control has been outlined. This includes a computerized mathematical model to be verified by experimental studies using a gas chromatograph. Fuel cells constructed with thinner electrolyte vehicles have shown improved performance characteristics. Cells constructed with a new combination of electrodes are showing excellent life characteristics, although the initial output is slightly lower than cells constructed with previous electrode combinations. Operation of units made up of a number of single cells connected in parallel has been proven feasible. The

parallel connected cells produce current in proportion to their ability. A thermal mockup of a gas cooling system has been designed and is under construction. Data acquired from tests on this unit will be used in design of a cooling system for a 1,500 watt fuel cell system. Author

N64-16276* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TAPCO Div.
Monthly Progress Report No. 1 for July 1962 [DEVELOPMENT OF "OSMOTIC STILL" AND IMPROVEMENT OF PERFORMANCE OF DUAL MEMBRANE FUEL CELL]
[1962] 6 p
(NASA Contract NAS3-2551)
(NASA CR-55699) OTS: $1.10 ph, $0.80 mf

This report deals with the experimental determination of the characteristics of a still for the removal of potable water from an electrolyte that is circulated through the dual membrane of a fuel cell. This electrolyte consists of a mixture of H_2SO_4 and water in a concentration of about 30%. The operation of the dual-membrane fuel cell produces H_2O in the electrolyte compartment of the fuel cell, resulting in the dilution of the electrolyte. For normal operation of the cell, H_2O must be removed. When fuel cells are employed as a source of auxiliary power in manned space vehicles, the removed H_2O is used for drinking purposes. It has been found that "osmosis" can be used for removal of H_2O from the acid-water solutions. Test-rig-requirements planning, material and parts procurement, and test-apparatus fabrication are discussed in connection with the use of membranes under highly controlled conditions, and in the study of the behavior of various types of membranes, such as cation and anion, under varying environments of pressure, temperature, acid concentration, etc. I.v.L.

N64-16277* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TAPCO Div.
Monthly Progress Report No. 2 for August 1962 [DEVELOPMENT OF "OSMOTIC STILL" AND IMPROVEMENT OF PERFORMANCE OF DUAL MEMBRANE FUEL CELL]
[1962] 12 p
(NASA Contract NAS3-2551)
(NASA CR-55700) OTS: $1.60 ph, $0.80 mf

The current program status in the development of an "osmotic still" and in the improvement of performance of a dual-membrane fuel cell includes the following: (1) Nearly all materials and parts for developmental work have been received. All of the test-rig parts in need of machining were fabricated with the exception of perforated membrane supports for the test unit. Polyvinyl dichloride and cast methyl methacrylate are undergoing precautionary compatibility tests for possible adverse reaction to acids. (2) Design studies have been initiated on an immersion-bath configuration for test cells, electrolyte and gas controls, electrolyte pumps, and fail-safe procedures. Preliminary design of three immersion baths for use in materials testing has begun. An engineering survey on the strength and compatibility of various structural and operational components in 6N H_2SO_4 from 30° to 95° C, related to the immersion baths, is being conducted. A new electrode form, a sintered electrode, has been tested in a 2-in. by 2-in. dual-membrane fuel cell. I.v.L.

N64-16278* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TAPCO Div.
Monthly Progress Report No. 3 for September 1962 [DEVELOPMENT OF "OSMOTIC STILL" AND IMPROVEMENT OF PERFORMANCE OF DUAL MEMBRANE FUEL CELL]
[1962] 8 p
(NASA Contract NAS3-2551)
(NASA CR-55702) OTS: $1.10 ph, $0.80 mf

The current program status includes: (1) The test-rig assembly for development tests of the "osmotic still" has been completed and checked out. (2) The design of an improved, single fuel-cell unit has been completed. (3) A materials-testing program for the development of fuel cells is underway. Duplicate samples of platinized titanium, titanium, Tri-Lox mesh and epoxy gasketing material have been immersed in 6N H_2SO_4, and the resulting assemblies maintained at 30°, 60°, and 95° C. (4) The purchase of material and dies needed for single-cell construction is almost complete. (5) The construction of the control and regulatory systems for fuel-cell development is underway. (6) Preliminary data have been obtained on the durability of the "sintered" electrode. Although the performance of these electrodes in 2-in. by 2-in. test cells drops off, the total current voltage at given current densities continues to be higher than that usually obtained from similar 2-in. by 2-in. cells with pasted electrodes. Efforts are underway to eliminate this drop off. I.v.L.

N64-16279* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TAPCO Div.
Monthly Progress Report No. 5 for November 1962 [DEVELOPMENT OF "OSMOTIC STILL" AND IMPROVEMENT OF PERFORMANCE OF DUAL MEMBRANE FUEL CELL]
[1962] 10 p
(NASA Contract NAS3-2551)
(NASA CR-55693) OTS: $1.10 ph, $0.80 mf

The current program status includes: (1) A total of four tests with cation membranes were made. In each of these tests, extracted H_2O in the condenser was contaminated with acid. Also, in each case, postest examination of the membranes and gaskets revealed them to be sound and without defect. Acid sweating of the membrane on the air side was found as soon as the electrolyte started circulating on the opposite side. An experiment to coat the Monel metal support screens with a thin layer of Teflon was performed in order to obtain a nonwetting screen surface and to provide an acid-resistant coating on the Monel metal screen used as a filler in the test housing. The experiment was successful. (2) Two cells were placed on life test at 30° C, using the gas and electrolyte compartments machined from pieces of 60-mil epoxy glass. (3) A constant-temperature bath capable of holding four cells at 60° C was completed. (4) Duplicate samples of gold-plated titanium, Tri-Lox mesh, epoxy, buna N, Plaskon, Kel-F, 9-oz glass-backed membranes, and Monel metal have been immersed in 6N H_2SO_4 and the bath maintained at 60° and 95° C. (5) Paste and sintered electrodes have been prepared for the 60° C runs. (6) Control equipment for four 60° C cells has been set up. I.v.L.

N64-16280* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Tapco Div.
Monthly Progress Report No. 6, December, 1962 [DEVELOPMENT OF AN "OSMOTIC STILL" AND IMPROVEMENTS IN THE PERFORMANCE CHARACTERISTICS OF THE IONICS DUAL MEMBRANE FUEL CELL]
15 Jan. 1963 21 p
(NASA Contract NAS3-2551)
(NASA CR-55697) OTS: $2.60 ph, $0.83 mf

Five successful tests were completed with anion membranes. During these tests, the temperature ranged from 175° to 200° F and the pH of the condensate was from 4 to 5. Water extraction rates were extremely small. The Monel metal support screens showed extreme corrosion and were recoated with Teflon. Kel-F nonwetting coatings were investigated. A

peristaltic-type pump was installed to replace the faulty acid vane-type pump in the test rig. Materials testing of organic and metallic components of fuel cells is in progress. E.W.

N64-16281* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Tapco Div.
Monthly Progress Report No. 7, January, 1963 [DEVELOPMENT OF AN "OSMOTIC STILL" AND IMPROVEMENTS IN THE PERFORMANCE CHARACTERISTICS OF THE IONICS DUAL MEMBRANE FUEL CELL]
15 Feb. 1963 11 p
(NASA Contract NAS3-2551)
(NASA CR-55698) OTS: $1.60 ph, $0.80 mf

Progress is reported as follows: (1) Fourteen successful test runs on the AMF C-60 cation membrane were completed over an electrolyte temperature range from 125° to 200° F. (2) Three successful test runs on the AMF C-103 cation membrane were completed at 125° F. (3) The water extracted from all tests indicated a pH of four or above. (4) Kel-F dispersion was applied to the Monel support screens for corrosion resistance. (5) In the areas of materials testing and electrode development, studies of membrane leakage were carried out, single-cell studies were continued, and multiple-cell studies were initiated. (6) Experimental work on the resistance of various materials to chemical attack by 6N H_2SO4 at 95° C was concluded, and results are reported. (7) The results of tests of nonmetallics for use as competitive ion-exchange membranes, gaskets, and gas compartments, and as mesh-spacers in electorolyte compartments are given. (8) Efforts to prepare electrodes that permit the drawing of given current densities at higher voltages were continued. (9) Successful cell performance was demonstrated by maintaining 16 amps/ft^2 at more than 0.8 volts for 72 hours until shutdown occurred by control system malfunction. R.T.K.

N64-16282 Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Tapco Div.
Monthly Progress Report No. 8, Feb. 1963 [DEVELOPMENT OF AN "OSMOTIC STILL" AND IMPROVEMENTS IN THE PERFORMANCE CHARACTERISTICS OF THE IONICS DUAL MEMBRANE FUEL CELL]
15 Mar. 1963 48 p
(NASA Contract NAS3-2551)
(NASA CR-55695) OTS: $4.60 ph, $1.64 mf

Ionic membranes MC 3142, MA 3148, XLMA 3236, and XLMC 3235 were determined to be unsuitable for an "osmotic still", and testing of these membranes was discontinued. Successful test runs were completed with the AMF C-60 membrane. In the dual membrane fuel cell improvement program, progress was made in the areas of test rig control and operation, membrane and electrode screening, successful life testing, delineation of the source of liquid in the cell gas streams, determination of the effect of gas circulation rates on cell performance, and finalizing the design of and expediting procurement of materials for the multiple cell batteries. R.L.K.

N64-16300 Texas Instruments, Inc., Dallas, Tex.
MOLTEN-CARBONATE FUEL BATTERY PROGRAM Quarterly Progress Report, 15 Feb.-15 May 1963
[1963] 58 p
(Contract DA-44-009-AMC-54(T))
(TI-08-63-63; AD-405571)

Power obtainable from single cells on hydrogen fuel using the 4 3/16-in. electrode diameter assembly has been increased from an average of 60 to about 100 w/ft^2 at 0.7 v by improvements in the fuel electrode structure and reduction in electrical resistance. These cells produce approximately 60 w/ft^2 at 0.5 v on a fuel composed of 50:50 hydrogen and carbon dioxide. A concentration of 0.2 mole percent of hydrogen sulfide in the fuel gas was not found detrimental in a 1,000 hr test. A 100-watt battery design has been constructed. A laboratory model of the JP-4–air partial oxidation unit has produced 12.5 ft^3/hr of a gas stream containing 50 to 60 percent gaseous fuel (mostly hydrogen and carbon monoxide), 35 to 40 percent nitrogen, and 5 to 10 percent carbon dioxide. A series of five additives for the molten-carbonate electrolyte have been screened, (Na_2MoO_4, Na_2CrO_4, Na_2WO_4, Na_2S, and Ba_2ZnO_2). Polarization and current interrupter studies of anodes fueled with simulated reformed hydrocarbons indicate no adverse anode polarization over results obtained using hydrogen fuel. Author

N64-16319* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TAPCO Div.
Monthly Progress Report No. 9 For Mar. 1963 [OSMOTIC STILL AND IONICS DUAL MEMBRANE FUEL CELL DEVELOPMENT]
[1963] 27 p
(NASA Contract NAS3-2551)
(NASA CR-55696) OTS: $2.60 ph, $1.01 mf

The final performance test with the AMF C-60 membrane was completed. A water extraction rate of 136 cc/hr-ft^2 was obtained at an electrolyte temperature of 200° F, a vapor pressure of 4.36 psia, and an acid pressure of 9.0 psia. A preliminary design of the 2-kw unit was completed, and design specifications are given. Plastic-materials-compatibility test results are presented. Various methods of application of silicon rubber compounds for gasketing purposes have been tested; in general, these compounds are adequate, but application technique is extremely critical. Preliminary design of the test rig for the 2-kw still 100-hour performance test is shown. Single cells were run continuously up to 1000+ hours with satisfactory performance. A cell was successfully run at about 150 amps/ft^2. A maximum power density of over 40 watts/ft^2 was achieved. Techniques to assemble and fill 5-cell batteries were developed, and the batteries were run successfully for 100 hours with output voltages over 3.5 v at 24 amps/ft^2. R.L.K.

N64-16320* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TAPCO Div.
Monthly Progress Report No. 11 for May 1963 [DEVELOPMENT OF "OSMOTIC STILL" AND IMPROVEMENT OF PERFORMANCE OF DUAL MEMBRANE FUEL CELL]
15 Jun. 1963 15 p
(NASA Contract NAS3-2551)
(NASA CR-55701) OTS: $1.60 ph, $0.80 mf

The fabrication of all component parts for the 2-kw "Osmotic Still," with the exception of the gaskets, was completed. The construction of the test rig required for performance evaluation of the 2-kw "Osmotic Still" was completed. Calibration of the flow meters was completed. The 10-cell battery was assembled and run for more than 100 hours. At the design current density of 24 amps/ft^2, a voltage of 7.75 ±0.18 was maintained throughout the 100-hour test as compared to a specified minimum of 6.8 volts. Battery performance corresponded to 100 watts at 6.8 volts as compared to a specified minimum of 40.8 watts. Design of the 2-kw battery continued; and further experimentation of a 5-cell battery was undertaken to allow more accurate prediction of the rates at which liquid accumulates in the gas streams. R.T.K.

N64-16323* Electric Storage Battery Co., Raleigh, N.C. Missile Battery Div.
Addendum to Final Report [DISCHARGE TESTS, STORAGE CAPACITY RETENTION AND VOLTAGE REGULATION OF STORAGE CELLS]
D. B. Colbeck 14 Jun. 1963 23 p refs
(NASA Contract NAS5-1607)
(NASA CR-55785; ESB-E-32-63, Final Addend.) OTS: $2.60 ph, $0.89 mf

Data from tests in the following areas are presented: (1) standard discharge tests; (2) vacuum discharge tests; (3) charged storage-capacity retention; and (4) voltage regulation. P.V.E.

N64-16329* Electric Storage Battery Co., Raleigh, N.C. Missile Battery Div.
DEVELOPMENT OF SEALED LOW RATE SILVER OXIDE-ZINC CELLS Fourth Quarterly Report, 22 Aug.-21 Dec. 1962
D. B. Colbeck 21 Dec. 1962 29 p
(NASA Contract NAS5-1607)
(NASA CR-55634; ESB-E-96-62) OTS: $2.60 ph, $1.07 mf

Research was conducted to design, develop, and test a standard line of low-rate, sealed, secondary silver oxide–zinc cells for space applications. A total of 84 cells have been completed and charged. Burst pressures of cycolac cell cases were measured at 78° F with cases unsupported, and cycling tests were performed. Sealed cells were activated and completely drained of excess electrolyte. These were compared with sealed cells flooded with the electrolyte, and with cells having the electrolyte halfway up the plates. The cells with essentially dry plates gave maximum overall performance. C.L.W.

N64-16333* Hughes Aircraft Co., Culver City, Calif. Aerospace Group
RIGIDIZED INFLATABLE SOLAR ENERGY CONCENTRATOR First Quarterly Progress Report, Aug.-Nov. 1963
S. Schwartz 15 Nov. 1963 23 p
(NASA Contract NAS1-3244)
(NASA CR-55733) OTS: $2.60 ph, $0.89 mf

Evaluations are being conducted on techniques for rigidizing an inflatable parabolic solar energy collector in a space environment. The stress–relaxation method of forming the parabola is discussed, along with the distortion problems found as the result of the Mylar stresses. Materials for adhering the Mylar film to the polyester laminate are described. It was found that polysulfide coatings in conjunction with a mechanical "lock" fabric resulted in good assembly of the Mylar to the polyester rigidizing laminate. Satisfactory optics were not obtained, however, with these assemblies. Good optical surfaces were obtained when an epoxy rigidizing laminate was used, indicating that the high shrinkage of the polyester was at fault. Author

N64-16334* Electro-Optical Systems, Inc., Pasadena, Calif.
RESEARCH AND DEVELOPMENT OF HIGH EFFICIENCY LIGHTWEIGHT SOLAR CONCENTRATORS Monthly Progress Report for February 1962
M. A. Pichel 15 Mar. 1962 7 p
(NASA Contract NAS7-86)
(NASA CR-55781; EOS-2100-M-4) OTS: $1.10 ph, $0.80 mf

Activities are reported in the following areas: (1) concentrator design; (2) small-scale studies of support structures—continued effort on variations of the back-mounted torus design and development of experimental platings; (3) sixty-inch-diameter concentrator development; (4) plating studies—completion of initial physical property tests on samples plated in the normal sulfamate nickel solution without stress reducers; results of tensile tests and microhardness measurements are presented; and an effective chromium plating solution was achieved for providing a highly reflective chromium overcoat on reflective nickel samples; and (5) coating studies—the production of approximately 50 electroformed-nickel sample surfaces were for the reflectivity tests. R.T.K.

N64-16335* Electro-Optical Systems Inc., Pasadena, Calif.
RESEARCH AND DEVELOPMENT OF HIGH EFFICIENCY LIGHTWEIGHT SOLAR CONCENTRATORS Monthly Progress Report for April 1962
M. A. Pichel 15 May 1962 7 p
(NASA Contract NAS7-86)
(NASA CR-55782; EOS-2100-M-5) OTS: $1.10 ph, $0.80 mf

Activities are reported in the following areas: (1) concentrator design; (2) small-scale studies of support structures; (3) five-foot-diameter concentrator development (special equipment, and 5-foot experimental plating); (4) plating studies—continuing of testing and analyses on all of the plating paths; and (5) coating studies–coating of a number of 5-inch-diameter flats with various combinations of vacuum-deposited reflective and protective surface coatings. The success of the subsequent plating operation appeared to be directly dependent on the quality and reproducibility of the original vacuum-deposited coatings. R.T.K.

N64-16336* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TAPCO Div.
Monthly Progress Report No. 10 for April 1963 [PROGRAM FOR DEVELOPMENT OF AN "OSMOTIC STILL" AND IMPROVEMENTS IN THE PERFORMANCE OF THE IONICS DUAL MEMBRANE FUEL CELL]
15 May 1963 42 p
(NASA Contract NAS3-2551)
(NASA CR-55735) OTS: $4.60 ph, $1.46 mf

Activities carried on and results observed during the report period included: (1) The design of a 2-kw "osmotic still" and the construction of detailed drawings were completed. (2) Fabrication of a test unit still was initiated and nearly completed. (3) Three 5-cell batteries were assembled. Four runs of 100 hours or more were completed. In only one of the runs was the voltage not maintained at 3.4 v or higher at a current density of 24 amps/ft^2. (4) The best battery, number 3, produced an average voltage of 4.00 v at 24 amps/ft^2 over a 133-hr run. (5) A polarization curve taken on battery 3 indicated an average cell conductance of 369 mhos/ft^2 and a maximum power density of 64.8 w/ft^2 for an average cell. P.V.E.

N64-16406 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON ONE SYSTEM OF STEP-TYPE EXTREMAL CONTROL
Ye. D. Garber 13 Feb. 1962 13 p refs Transl. into ENGLISH from Energ. i Avtomatika, no. 5, 1960 p 169–173
(FTD-TT-62-1884/1+2+4; AD-298653)

Possible variations of a proportional-step system of extremal control are discussed. It is assumed that the controlled object possesses an extremal (minimum) characteristic that depends on a single independent variable. The results can be extended to the case of an extremum of any sign depending on several controlled parameters. P.V.E.

N64-16419 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STABILITY IN NONLINEAR CONTROL SYSTEMS

A. M. Letov 24 Oct. 1963 434 p refs Transl. into ENGLISH of the book "Ustoychivost' Nelineynykh Reguliruyemykh Sistem" Moscow, Gos. Izd. Fiz.-Mat. Lit., 1962 p 1–483
(FTD-TT-63-399/1+2; AD-430441)

The problems considered concern absolute stability, i.e., stability under unbounded perturbations, with regulators of arbitrary nonlinear characteristics. Attention is given to the equations of control systems and the definition of absolute stability. The initial equations of the control systems are converted to various canonical forms, which are employed in the solution of the principal problems. The principal results are treated, and consideration is given to simplified stability criteria for inherently stable control systems with a single regulator. The absolute stability of a control system with two regulators is discussed, as is a study of first approximation stability and stability under continuous disturbing forces. The stability of unsteady motion in any time interval is investigated, and a method is proposed for solution. C.L.W.

N64-16500 National Cash Register Co., Dayton, Ohio
FEASIBILITY INVESTIGATION OF CHEMICALLY SPRAYED THIN FILM PHOTOVOLTAIC CONVERTERS Technical Summary Report, 1 Feb.-31 Oct. 1963
R. R. Chamberlin and J. S. Skarman Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab. [1964] 55 p refs
(Contract AF 33(657)-7919)
(ASD-TDR-63-223, Pt. 2; AD-430736)

The objectives were (1) to improve the characteristics of chemically sprayed, large-area, thin-film solar cells from the standpoint of efficiency, weight and lifetime, and (2) to fabricate for delivery a one-foot-square photovoltaic array. The previous demonstration of feasibility of the chemical spray process used a CdS-Cu_xS_y thin-film combination deposited on a one-eighth-in. glass substrate. Research has been primarily directed to extending this feasibility of material and process to the fabrication of a solar cell using metal foil as a substrate. This research also covered the demonstration of heterogeneous junction photovoltaic effect using chemically sprayed films with Si, CdTe, and GaP. One photovoltaic thin-film CdS array, one-foot square, was fabricated for delivery. The array, which was composed of nine cells, each approximately four inches square, had an efficiency of 0.03%. Author

N64-16566 Martin Co., Baltimore, Md. Nuclear Div.
DEVELOPMENT OF AN ENCAPSULATED THERMIONIC POWER GENERATOR Quarterly Technical Progress Report, 1 Nov. 1962-31 Jan. 1963
15 Feb. 1963 13 p
(Contract AF 33(657)-10077)
(MND-2945-1; AD-296232)

The engineering design of the double diode thermionic power generator has been completed. The manufacture of other generator components including the collector temperature control assembly and the ceramic-to-metal seals has been initiated. The engineering design of the clad fuel elements has been completed, and the first element, similar in configuration to the fueled emitter, has been fabricated. Author

N64-16664 Gt. Brit. Ministry of Aviation, Mottingham Technical Information and Library Services
OPTIMUM CONTROL IN A NON-LINEAR SYSTEM [OPTIMAL'NOE UPRAVLENIE V ODNOI NELINEINOI SYSTEME]
Tszyan Sun Jan. 1964 16 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), v. 4, 1960 p 3–14
(TIL/T-5462)

Transient processes, optimum in regard to speed, in control systems containing a rotary generator and a d.c. motor are analyzed. The motor excitation voltage is considered as the second independent control parameter. Methods of synthesizing the optimum control device are proposed. The example of the synthesis for simplified second- and third-order systems is given. Author

N64-16669 Joint Publications Research Service, Washington, D.C.
AUTOMATIC CONTROL SYSTEMS IN THEORY AND PRACTICE
11 Mar. 1964 30 p refs Transl. into ENGLISH of 5 articles from Dokl. Akad. Nauk SSSR (Moscow), v. 153, no. 4, 1963 p 747–750 and 768–782
(JPRS-23613; OTS-64-21761) OTS: $0.75

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N64-16672 Iowa State U. of Science and Tech., Ames
ELECTROCHEMICAL PROCESSES IN FUSED SALTS
Lowell Alvin King (Ph.D. Thesis) and F. R. Duke Jul. 1963 102 p refs
(Contract W-7405-ENG-82)
(IS-667) OTS: $2.25

The practicability of direct-current specific conductivity determinations of fused salt systems is demonstrated in this study. The direct current conductivities of $LiNO_3$, $NaNO_3$, KNO_3, and their binary mixtures were determined. Agreement with published alternating current values, where available, was excellent. A carbon dioxide formation cell is described. The cell consisted of a reversible platinum–oxygen cathode, a graphite–carbon dioxide anode, and an oxyanionic electrolyte of fused Na_2WO_4–WO_3 mixtures. Cell voltages were about 20% below theoretical values. Anodic and cathodic overpotentials at each electrode were studied. The platinum electrode exhibited concentration polarization. In all cases of electrode polarization studied, the number of electrons transferred in the rate-determining process was one. Author

N64-16699* Gould-National Batteries, Inc., Minneapolis, Minn. Research and Engineering Center
RESEARCH AND DEVELOPMENT PROGRAM ON SEALED NICKEL-CADMIUM CELLS FOR SPACE USE Final Report
William Jakobi 30 Apr. 1963 91 p refs
(NASA Contract NAS5-1045)
(NASA CR-55845) OTS: $8.60 ph, $2.93 mf

The three areas investigated on the sealed Ni-Cd system were: (1) separator materials; (2) cell closure and improvement in the performance of the glass-to-metal seal; and (3) a high-vacuum method of testing the cell seal. A study of the separator material involved the following parameters: mechanical

strength, porosity, permeability to oxygen, absorbency, rate of absorption, reactivity in KOH, reactivity with KOH in the presence of oxygen, electrical performance in the sealed seal, cell internal pressure on overcharge, and the performance in the cell under acceleration. Generally speaking, nylon, dynel, and polypropylene performed better as separator materials than did any of the other resin types tested. A heliarc weld technique, developed for cell weld closure, was very reliable. A nylon gasket inner seal was developed that provides a more effective barrier between the glass and the electrolyte. A test unit was designed and built that makes it possible to read test-chamber pressures by reading the current drawn by an ionization pump. Pressure readings can be obtained within a time range of from 2 hrs. after placing the test cell in the chamber, and without requiring the test system be shut down or that the test chamber be sealed off. I.v.L.

N64-16714* Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF THE SPACE STORABILITY OF PRESSURIZING GASES Final Summary Report, Feb. 18, 1962-Dec. 31, 1963
R. F. Muraca 31 Dec. 1963 18 p refs
(NASA Contract NAS7-105; SRI Proj. PSU-4000)
(NASA CR-55841) OTS: $1.60 ph, $0.80 mf

Laboratory experiments indicate that a column of lithium borohydride powder will generate hydrogen on demand by reaction with controlled additions of water to an asbestos wick when cobaltous chloride is used as a catalyst and asbestos pulp is interspersed throughout to prevent formation of impermeable, glassy coatings of lithium metaborate. A comparison is made of computed storage efficiencies for pressurized hydrogen and nitrogen in a system designed to generate hydrogen at about 1.5 atm from lithium borohydride with water added in a controlled fashion by flow through a porous plug. The maximum storage efficiency of such a hydrogen gas generating system, based on its use in an attitude-control system, approaches 27.7 lb-sec of impulse per pound of system weight for a mission requiring a total impulse of 10,000 lb-sec; hydrogen gas and nitrogen gas stored at 1,500 psia have values of 16.6 and 33.9 lb-sec per lb, respectively. Thermal decomposition of lithium borohydride or of other materials presents no advantage. Author

N64-16716* Space Technology Labs., Inc., Redondo Beach, Calif. Solid State Physics Lab.
CHARGED PARTICLE RADIATION DAMAGE IN SEMICONDUCTORS, IX: PROTON RADIATION DAMAGE IN SILICON SOLAR CELLS Final Report
J. M. Denney and R. G. Downing 31 Aug. 1963 40 p refs
(NASA Contract NAS5-1851)
(NASA CR-55829; MR-34; Rept. 8653-6026-KU-000) OTS: $3.60 ph, $1.40 mf

A series of experiments using protons of energies from 6.7 to 26 Mev were performed to measure the energy dependence of proton radiation damage on p on n and n on p silicon and gallium arsenide solar cells. The experimental results indicate that: (1) the energy dependence experimentally observed in this energy range is in agreement with the inverse energy dependence predicted on the basis of Coulomb scattering, and (2) the minority carrier diffusion length injection level dependence previously observed at 95.5 Mev is also observed at all the energies used in this series of experiments. The energy dependence is presented for solar cells under one sun equivalent radiation in terms of both K values and reciprocal critical fluxes. Author

N64-16717* Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
EVALUATION PROGRAM FOR NICKEL CADMIUM SEALED CELLS. ACCEPTANCE TEST OF GENERAL ELECTRIC COMPANY 3.0 AMPERE HOUR CELLS
H. M. Schultz 23 Aug. 1963 22 p
(NASA Order W-11252-B)
(NASA CR-55828; QE/C-63-321) OTS: $2.60 ph, $0.86 mf

This report is the seventh of a series of seven of the Acceptance Test Section. It gives the results of the acceptance tests of some 200 3-amp-hr-size cells supplied by General Electric Company. The cells are rated at 3.0 amp hr by the manufacturer. From the results of this test, it can be concluded that: (1) The weak point of the General Electric Company 3.0-amp-hr cells is the sealing of the filler tube, as evidenced by 20 leakers out of 224 cells tested. (2) The capacity of the cells was in the acceptable range of 3.38 to 4.08 amp hr. Author

N64-16736* Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science
RESEARCH AND DEVELOPMENT OF A HIGH CAPACITY NONAQUEOUS SECONDARY BATTERY Second Quarterly Report
[1963] 37 p ref
(NASA Contract NAS3-2780)
(NASA CR-53087) OTS: $3.60 ph, $1.31 mf

Progress is reported in the development of the following: (1) secondary battery anode—basic electrochemical experiments, prepurification procedures, and properties of cathodic electrodeposits; (2) secondary battery cathodes; and (3) beryllium systems—preparation of organoberyllium compounds, and preparation of beryllium dialkyl salts. R.T.K.

N64-16738* Stanford U., Calif.
PIECEWISE-LINEAR SWITCHING FUNCTIONS FOR QUASI-MINIMUM-TIME CONTACTOR CONTROL SYSTEMS
D. K. Frederick Dec. 1963 115 p refs
(NASA Grant NsG-133-61)
(NASA CR-53101; SUDAER-178) OTS: $9.60 ph, $3.65 mf

Piecewise-linear switching functions are investigated for minimum-time regulator systems represented by a linear, constant parameter plant and a single controller. A performance criterion is defined in terms of the response times for a number of initial conditions. A qualitative method based upon root-locus techniques and the existence of certain periodic solutions is given for designing suboptimal linear switching functions, in order to initiate the search of the performance surface in a region where the surface exists and for determining which components of the switching function should be made piecewise-linear functions. The design methods are illustrated by synthesizing piecewise-linear switching functions which yield close-to-optimal step-function responses for third- and fourth-order plants having all of their poles on the imaginary axis of the s-plane. It is concluded that easily implemented, piecewise-linear switching functions can provide close-to-optimal response for a wide variety of plants and initial conditions. Author

N64-16747* General Motors Corp., Indianapolis, Ind. Allison Div.
DEVELOPMENT AND TESTING OF ELECTROLYTE MATRIX COMBINATIONS FOR MERCURY-POTASSIUM FUEL CELL Final Report

V. L. Decker, R. A. Murie, and W. S. Colwell Jan. 1964 132 p ref
(NASA Contract NASw-476)
(NASA CR-53108; Eng. Dept. Rept. 3709) OTS: $10.50 ph, $4.16 mf

A crack-free composite matrix for use in the potassium–mercury liquid metal cell has been developed utilizing MgO and employing special preparation and baking techniques. The molten salt electrolyte used in the composite is a ternary eutectic of KOH, KBr, and KI of 70-15-15 mole percents, respectively. Special design features employed in the construction of the cells included screens for support of the matrix, unique serrations to effect a positive seal utilizing the plasticity of the composite, and silicon rubber O-rings to exclude atmospheric contamination. Maximum performance data utilizing potassium as the anode metal indicate that the goal of the systems study resistivity-thickness product, $\gamma t_e = 0.5$, may be achieved if the electrolyte composite matrix thickness is reduced to 1/16 in. Author

N64-16750* New Mexico U., Albuquerque Engineering Experiment Station
MAGNETORESISTANCE AND SUPERCONDUCTIVITY FOR APPLICATION TO DC TO AC CONVERSION Semi-Annual Status Report
Richard Bechtel and W. W. Grannemann Dec. 1963 19 p refs
(NASA Grant NsG-279-62)
(NASA CR-53083; PR-49) OTS: $1.60 ph, $0.80 mf

Considerable effort has been directed toward assembling a number of test samples designed to deliver a maximum amount of information in a minimum test time. In addition, an attempt has been made to outline experiments that will determine the feasibility of the superconducting-switch converter. Also, the status of the Theory of Superconductivity is discussed. I.v.L.

N64-16751* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Electromechanical Div.
BRAYTON CYCLE SOLAR COLLECTOR DESIGN STUDY PROGRAM, ITEM II. A. Monthly Progress Report No. 6, Jan. 1, 1964–Jan. 31, 1964
Edward S. Kovalcik 11 Feb. 1964 3 p
(NASA Contract NAS3-2789; Proj. 512-004235-08)
(NASA CR-53082) OTS: $1.10 ph, $0.80 mf

Progress is summarized as follows: The design layout of the recommended Brayton cycle concentrator was completed and submitted to NASA for approval. Fabrication and handling specifications are being completed. All computer solutions of the solar reflector performance have been completed, and cavity flux profile computations are continuing. Structural and thermal analysis tasks have been completed. I.v.L.

N64-16759* Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
ROCKET BOOSTER CONTROL. SECTION 16: A MINIMAX CONTROL FOR A PLANT SUBJECTED TO A KNOWN LOAD DISTURBANCE
H. E. Gollwitzer 1 Jan. 1964 17 p refs
(NASA Contract NASw-563)
(NASA CR-53115; MH-MPG-1541-TR-16) OTS: $1.60 ph, $0.80 mf

An open-loop optimal control problem is considered for plants that can be represented by linear recurrence equations. It is assumed that the control is bounded and that a known disturbance is present. Then the problem is to choose a control sequence that minimizes an error criterion based on a generalized distance function. The problem is formulated in a manner such that linear programing techniques can be used to give the optimal control sequence. Estimates on the size of the resulting linear programing problem are presented. A method is cited for determining an optimal control sequence as a result of varying a nominal disturbance, provided the optimal control is known for the nominal case. An example is presented to illustrate the techniques involved. Author

N64-16761* Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
ROCKET BOOSTER CONTROL. SECTION 14: MINIMUM DISTURBANCE EFFECTS CONTROL OF LINEAR SYSTEMS WITH LINEAR CONTROLLERS
C. A. Harvey 30 Dec. 1963 33 p ref
(NASA Contract NASw-563)
(NASA CR-53110; MH-MPG-1541-TR-14) OTS: $3.60 ph, $1.19 mf

An optimal control problem for linear systems is considered. The optimal controller is one of a class of allowable controllers that minimizes the effect of the worst possible disturbance from the class of uniformly bounded disturbances. When the class of allowable controllers is a family of fixed-gain controllers, a method of solution is presented. For sufficiently simple systems the optimal controller may be found by analytical techniques. However, for most realistic systems the use of a computer is required to determine the optimal controller. Author

N64-16762* Globe-Union, Inc., Milwaukee, Wis.
THE DEVELOPMENT OF HIGH ENERGY DENSITY PRIMARY BATTERIES, 200 WATT HOURS PER POUND OF TOTAL BATTERY WEIGHT MINIMUM Second Quarterly Report, 1 Nov. 1963–31 Jan. 1964
Warren L. Towle [1964] 64 p
(NASA Contract NAS3-2790)
(NASA CR-53111) OTS: $6.60 ph, $2.12 mf

Progress toward the achievement of a primary battery, with 200 watt-hours per pound of total battery weight, is reported for the following areas: (1) the development of new energy density curves to relate the cell potentials; (2) the development of the thermodynamics for six new electrode couples; (3) an investigation of a large number of electrolyte systems; (4) an investigation of the stability of electrode materials; (5) an investigation of the electrochemistry of the magnesium anode; and (6) the planned construction of a small breadboard battery. I.v.L.

N64-16766* Electro-Optical Systems, Inc., Pasadena, Calif.
EVALUATION OF REGENERATIVE FUEL CELL Final Report, 25 Jun. 1962–25 Feb. 1963
J. J. Rowlette 12 Jul. 1963 79 p refs
(NASA Contract NAS7-181)
(NASA CR-55849; EOS-3310-Final) OTS: $7.60 ph, $2.57 mf

A significant part of the program was devoted to work on the hydrogen–silver oxide "fuel cell." Methods were sought to overcome some of the major disadvantages of the Ag_2O electrode. The limitations of these electrodes are believed to be connected with the high resistivity of the Ag_2O. Resistivities of several doped silver oxides were measured, and extensive testing was then performed on electrodes made from the best two of these doped oxides. Performance of these electrodes was compared with that of undoped Ag_2O electrodes. In connection with the hydrogen–silver oxide concept, hydrogen storage in palladium and in Raney nickel was evaluated for the nonpressure storage of the hydrogen. It was

concluded that for palladium this approach is feasible, but for Raney nickel it is not feasible, with the present design. Also, electrode studies were conducted to increase the power densities of the cell and to improve its efficiency. These studies resulted in increases in power densities, at a given temperature, of approximately a factor of five over performance at the start of the program. In addition, the capacity of the cells was improved. I.v.L.

N64-16767* Electro-Optical Systems, Inc., Pasadena, Calif.
EVALUATION OF REGENERATIVE FUEL CELL Final Report, 21 Sep. 1960-9 Mar. 1962
Harvey A. Frank 9 Apr. 1962 52 p refs
(NASA Contract NAS7-7)
(NASA CR-55848; EOS-1584-Final) OTS: $5.60 ph, $1.76 mf

The regenerative hydrogen–oxygen fuel cell configuration was modified, the gases were stored in separate containers, and a negative electrode, activated with a coating of platinum black, was used. Fabrication and testing of a cell with the above modifications established that the self-discharge rate was markedly reduced, and that the cell could deliver reasonable currents at room temperature. Three cells are undergoing life-cycle tests. Additional investigations on this cell include the effect of vibration, shock, and acceleration on performance. The safety hazards involved in excessive overcharging and the sudden release of pressure of one gas were also investigated. None of the above environmental tests were found to have any effect on cell performance, and no apparent safety hazards are involved in the operation of the cell. The development of a 9-cell unit was successfully completed. Also, a preliminary evaluation of a "silver–hydrogen" cell was carried out. Based on the first test results, the system offers a potentially high power efficiency of over 90%. I.v.L.

N64-16788 Sundstrand Aviation-Denver, Denver, Colo.
ANALYSIS AND FEASIBILITY STUDY OF THERMAL ENERGY STORAGE DEVICES FOR SPACE VEHICLE APPLICATIONS Technical Report, Mar. 1960-Apr. 1963
R. N. Bailey, R. R. Conrad, L. S. Loseke, J. R. May, and R. F. Taylor Wright-Patterson AFB, Ohio, AF Aero-Propulsion Lab., Jan. 1964 181 p refs
(Contract AF 33(616)-6997)
(WADD-TR-61-118; AD-431201)

The stored energy is used for cycle heat input to a solar power system during shaded portions of the orbit path. Specific subjects of this report are: (1) generalized determination of energy storage requirements for various dynamic power systems; (2) experimental investigation of boiling heat-transfer rates of a representative Rankine cycle working fluid with heat released from a fusion-type storage material; (3) experimental determination of corrosion characteristics of various thermal energy storage materials with potential containment materials; and (4) an experimental and analytical study of a unique method using an electrical charge for reducing hydrogen diffusion rates through containment materials. Author

N64-16789 General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
STUDY OF A THERMOPHOTOVOLTAIC CONVERTER Report Number 4 (Final Report), Jan. 1, 1963-Dec. 31, 1963
Feb. 1964 135 p refs
(Contract DA 36-039-AMC-02255(E))
(TR-64-16, Final; AD-431557)

The current program status includes the following: (1) A reflectance goniometer was completed, and refined reflectance measurement techniques have yielded values of front surface gold-on-germanium reflectivity, and combined front-surface germanium and rear-surface germanium–gold reflectivities for both very smooth or specular samples and for nonspecular scattering specimens. (2) Results indicate that adequately transparent cells can be made with 4% long-wavelength transmission loss per round trip, with acceptable Fermi and doping levels. (3) It appears that the best design for a photovoltaic cell is germanium n-on-p^+ (irradiated on the n side), and that cells of acceptable electrical properties can be made by compromising between electrical and optical properties. Gridding appears to have no effect on the open-circuit voltages (up to 0.34 volts) that have been attained. Cell mounting by using overlapping appears to be the most promising. Power densities of 0.5 to 1.0 watt/cm^2 were confirmed. (4) SiC seems a likely material for the burner mantle. (5) Design studies for a burner with 30% stack loss were completed. Cylindrical geometry is preferred. I.v.L.

N64-16793 General Electric Co., Pleasonton, Calif. Vallecitos Atomic Lab.
RESEARCH AND DEVELOPMENT PROGRAM OF THERMIONIC CONVERSION OF HEAT TO ELECTRICITY Technical Summary Report [1 Aug.-31 Oct. 1963]
J. E. Van Hoomissen et al 31 Oct. 1963 185 p refs
(Contract NObs-88578; ARPA Order 219)
(GEST-2029; AD-429972)

Progress is reported in the following areas: (1) Two spacing configurations have undergone rigorous testing in a converter environment. A scalloped tungsten ring separating emitter from collector has proven particularly satisfactory. (2) Essentially pure alumina (A-976) ceramics have been metalized with a molybdenum-based coating containing calcia, magnesia, and alumina as bonding oxides. The sintering behavior of a number of types of molybdenum and alumina powders has been studied. (3) Preliminary results on the study of intercell discharges between series-connected thermionic converters suggest that intercell discharges will not occur through small cesium passageways (those of a few tens of mils in diameter). (4) No evidence of UO_2 fuel migration through tungsten clad at 2,000° C for 1,000 hours was found. (5) A survey of data on the properties of refractory oxides has been completed. Young's Modulus for yttrium oxide has been measured. Neutron activation analysis of impurities in yttrium oxide has been completed. Author

N64-16861 Atomics International, Canoga Park, Calif.
A REACTOR TRANSIENT HEAT TRANSFER MODEL
D. G. Mason and R. W. Winson 1 Mar. 1964 21 p ref
(Contract AT(11-1)-GEN-8)
(NAA-SR-7938) OTS: $0.50

The purpose of this study was to develop a transient heat-transfer model of a SNAP 8 reactor core, which could be programed on a general purpose electronic analog computer, using minimum equipment but maintaining a high degree of accuracy. In addition, the model must eliminate any erroneous response due to step changes in inlet coolant temperature. The transient responses of two models, both formulated from the physical system using the laws of conservation of mass and energy, are compared for step changes in power and inlet coolant temperature. One of the models is selected as having the desired transient accuracy in response to the input disturbances. Author

07 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis. *For related information see*: 18 Materials, Metallic; 19 Materials, Nonmetallic; and 26 Propellants and Combustion.

N64-16125 General Electric Co., San Jose, Calif. Vallecitos Atomic Lab.
THE MEASUREMENT OF OXYGEN TO METAL RATIO IN SOLID SOLUTIONS OF URANIUM AND PLUTONIUM DIOXIDES
W. L. Lyon Washington, AEC Div. of Tech. Inform., 31 May 1963 28 p refs
(Contract AT(04-3)-189)
(GEAP-4271) OTS: $0.75

A survey has been made of methods potentially useful for the determination of the oxygen to metal ratio in mixed oxides of uranium and plutonium. A gravimetric method was selected as being the most promising for adaptation in a short period of time. Development of the technique has resulted in a reliable method, which meets the requirements for unirradiated mixed oxide fuel samples. The method, based upon an equilibrium weight at 700° C in dry hydrogen, was shown to be capable of measurement of O/(Pu + U) ratios in 20% PuO_2–80% UO_2 pellets with a standard deviation of ±0.001. Author

N64-16150 Atomic Energy of Canada Ltd., Chalk River, Ontario
PRELIMINARY STUDY OF PICK-UP AND RELEASE OF FLUORINE BY ZIRCALOY
K. Beg and F. Brown Feb. 1964 21 p refs
(AECL-1903; CI-221) Available from Sci. Doc. Distribution Office, Atomic Energy of Canada: $0.50

Chemical polishing (pickling) or Zircaloy in HNO_3/HF solutions causes attachment of ~ 0.5 $\mu g/cm^2$ of fluorine. This fluorine is firmly bound and, so far, has only been removed by treatment with steam at 500°C (which causes appreciable corrosion of the Zircaloy surface). There is no significant difference in the overall fluorine pickup during "good" and "bad" pickling. All Zircaloy surfaces pick up 0.1 to 0.2 $\mu g/cm^2$ of fluorine from water containing 5 ppm of fluorine at pH 5.2; a considerable part of this pickup is readily reversible. Author

N64-16253 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
CHEMICAL PROCESSING TECHNOLOGY Quarterly Progress Report, Jan.-Mar. 1963
J. R. Huffman, J. A. Mc Bride, and J. R. Bower AEC Natl. Reactor Testing Station, 9 Sep. 1963 39 p refs
(Contract AT(10-1)-205)
(IDO-14616) OTS: $0.75

The current program status includes: (1) Aqueous zirconium fuel-processing studies resulted in a recommendation for changes that would increase the capacity of the ICPP hydrochloric acid dissolution process to 835 kg of zirconium per day. (2) Electrolytic dissolution studies have progressed to the installation and testing of a subscale pilot unit. (3) Waste-treatment studies, directed at adsorption of fission products from low-level wastes on natural earth materials, indicated that the presence of ethylenediamine tetraacetic acid or citric acid, common decontamination complexing agents, could markedly affect the adsorption. (4) The ICPP waste-calcining facility has been tested with radioactive tracer feed, found to meet desired or required operating standards, and is being readied for production operation with ICPP stored wastes. (5) Plant improvement studies included testing the effect of recirculation of dissolver solution in the continuous dissolution of aluminum fuel. I.v.L

N64-16337 Harshaw Chemical Co., Cleveland, Ohio Central Research Lab.
INVESTIGATION OF THE EXISTENCE OF OXYANIONS OF FLUORINE AND NITROGEN, AND THE NITROGEN-FLUORINE CATIONS Quarterly Technical Summary Report, 28 Oct. 1963-28 Jan. 1964
H. J. Bronaugh and S. I. Khayat 17 Feb. 1964 13 p
(Contract DA-31-124-ARO(D)-76; ARPA Order 402)
(HQ-76-4; AD-431278)

Additional data are presented for experiments concerned with the hydrolysis of nitrogen trifluoride. It has been shown that nitrogen trifluoride does not hydrolyze in water or in hydrochloric acid solutions. The data presented for the hydrolysis of nitrogen trifluoride in sodium hydroxide solution supports the following equation: $NF_3 + 4NaOH \rightarrow 3NaF + NaNO_2 + 2H_2O$. Author

N64-16338 Beryllium Corp., Reading, Pa.
PRODUCTION ENGINEERING MEASURE FOR BERYLLIUM OXIDE AND PARTS PRODUCED FROM IMPORTED ORES First Quarterly Progress Report, 1 Jul 1963-30 Sep. 1963
J. F. Blum [1963] 23 p
(Contract DA-36-039-AMC-01481(E))
(AD-430303)

A batch of 100 lb of high-purity-oxide control powder has been produced, and a mix has been prepared from a portion of the control powder. Test and qualification samples are presently being fabricated from the mix. Author

N64-16348 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEDUCTING ELEMENTAL SULFUR IN REACTIVE FUELS
A. G. Ryasnyanskaya 12 Feb. 1963 8 p Transl. into ENGLISH from Khim. Seraorgan. Soedin., Soderzhashch v Neftyakh i Nefteprod., v. 4, 1961 p 71–74
(FTD-TT-62-1451/1+2+4; AD-298661)

A method is developed for the detection of elemental sulfur in jet fuels. The method consists of direct titration of a 0.003 to 0.004 suspension of fuel in a solution of caustic soda in isopropyl alcohol. Titration takes place in a water and acetone medium, with heating in the presence of an acid–base indicator, bromocresol purple. Under the conditions of the experiment, the elemental sulfur reacts qualitatively with the caustic soda. The reaction is accompanied by the formation of sodium sulfide and sodium thiosulfate, which do not hydrolyze in the medium in question. A small excess of caustic soda is revealed by the change in the color of the indicator. The accuracy of the method, checked in artificial mixtures, is ±0.0002%. C.L.W.

N64-16357 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
OXIDATION OF URANIUM DIOXIDE
V. G. Vlasov and A. F. Bessonov 3 Apr. 1963 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Tsvet. Met. (Dzaudzhikau), no. 5, 1962 p 113–122
(FTD-TT-63-102/1+2; AD-402595)

The oxidation reaction kinetics of uranium dioxide with atmospheric oxygen were investigated for the temperature range 165° to 800° K and at air pressures from 2.5 to 600 mm Hg. Also investigated was the kinetic characteristics of UO_2 oxidation with pure oxygen for the temperature range 125° to 330° K

and at a pressure of 100 mm Hg. Phase conversion schemes are suggested for explaining the oxidation process of UO_2 at various temperatures. The apparent activation energy of the UO_2 oxidation process was calculated at various stages of oxidation. The effect of additions of alkali-metal carbonates and oxides of ThO_2, ZrO_2, and TiO_2 on the kinetic characteristics of the UO_2 oxidation processes in air is discussed. P.V.E.

N64-16430 Air Force Systems Command, Wright-Patterson AFB, Ohio

THE SPECTRAL AND PHOTOCHEMICAL PROPERTIES OF WATER-SOLUBLE ANALOGS OF CHLOROPHYLL

I. G. Savkina and V. B. Yevstigneyev (Akad. Nauk SSSR) 6 Feb. 1964 18 p refs Transl. into ENGLISH from Biofizika (Moscow), v. 8, no. 3, 1963 p 335–343
(FTD-TT-63-1008/1+2+4; AD-429885)

The spectral and photochemical properties of water-soluble derivatives of chlorophylls A and B and pheophytins A and B, which were obtained by the alkali hydrolysis of the initial pigments, were investigated. The derivatives were K-chlorophyllin A and B and the potassium salts of pheophytins A and B. The absorption spectra of these derivatives were measured in methanol, ethanol, and buffer solutions with pH values of 3, 5, 7, 9, and 11. The fluorescence spectra were measured in methanol and in a phosphate buffer with a pH of 7. The photoreducibility of the water-soluble analogs was demonstrated by adding both dissolved atmospheric oxygen and ascorbic acid in the presence of pyridine. I.v.L.

N64-16498 Texaco Experiment Inc., Richmond, Va.

INVESTIGATION OF THE DISSOCIATION CHEMISTRY OF $-NF_2$ COMPOUNDS Quarterly Summary Report, Aug.–Oct. 1963

U. V. Henderson, Jr., P. L. Goodfriend, H. A. Rhodes, and H. P. Woods 1 Nov. 1963 20 p refs
(Contract Nonr-1883(00))
(EXP-223; TM-1470; AD-430906)

Preparations are underway to study by means of the mass spectrometer the NF_2 dissociation induced by flash photolysis, in order to complement optical kinetic spectroscopy studies. The flash photolysis of NF_3 has been reexamined, using a sample cell and flash tube arrangement that permitted the use of photolysis radiation as low as 1,600A. No new features in the spectra of the flashed NF_3 attributable to dissociation of the NF_3 were observed. Equipment is being modified to allow flash photolysis kinetic spectroscopy spectra to be obtained in the vacuum ultraviolet region. Author

N64-16499 Texaco Experiment Inc., Richmond, Va.

INVESTIGATION OF THE DISSOCIATION CHEMISTRY OF $-NF_2$ COMPOUNDS Quarterly Summary Report, Nov. 1963–Jan. 1964

U. V. Henderson, Jr., P. L. Goodfriend, and H. P. Woods 3 Feb. 1964 7 p refs
(Contract Nonr-1883(00))
(EXP-223; TM-1496; AD-430758)

The work of the past quarter has consisted primarily of attempts to modify the flash photolysis apparatus for use in the vacuum ultraviolet. A number of source designs and optical arrangements have been tried, and the difficulties encountered are gradually being eliminated. Some preliminary investigations of the emission spectra produced by an electrical discharge through flowing NF_3 and N_2F_4 have been made in a search for the emission spectrum of NF. The spectra produced in both cases were identical and consisted primarily of nitric oxide, nitrogen, and fluorine bands. No features attributable to NF were observed. The emissions produced are characteristic of the final decomposition products rather than of intermediate fragments. Preparations are being made to search for emission of short-lived intermediate fragments in the electrically dissociated gases by exciting them with a capacitor discharge through the sampe cell. Equipment is also being assembled and tested to carry out the flash photolysis of N_2F_4 and NF_3 in the fast-reaction cell of the time-of-flight mass spectrometer. Author

N64-16509 IIT Research Inst., Chicago, Ill.

RESEARCH ON CHEMISTRY OF O_3F_2 AND O_2F_2 Yearly Summary Report, 1 Oct. 1962–31 Dec. 1963

Irvine J. Solomon 19 Feb. 1964 35 p refs
(Contract AF 49(638)-1175)
(IITRI-C227-6; AD-430716)

O_2F_2 appeared to be stable below −160° C, but decomposed above this temperature. It was found to react with certain metal fluorides to form a new class of compounds that are apparently oxygenyl (O_2^+) salts. The reaction of O_2BF_4 with chlorine produced an unstable purple product. The hydrolysis of O_2BF_4 produces oxygen, ozone, fluorine, and HBF_4. Although the ozone-to-oxygen ratio is variable, the sum of the two is equivalent to twice the amount of oxygen present in the original compound. The amount of ozone obtained is smaller for samples kept at room temperature for a short time. O_2F_2 does not react with some metals and is moderately reactive with others. It liberates the halogens from NaI and NaBr, and reacts explosively with the iodine formed in the first case. Studies were also made of the reaction of HNF_2 with various Lewis acids. R.T.K.

N64-16527 Gt. Brit. Ministry of Aviation, London Technical Information and Library Services

THE USE OF DIOXANE SULPHUR TRIOXIDE FOR DETERMINING THE ACTIVE HYDROGEN ATOM IN ALCOHOLS AND AROMATIC AMINES [PRIMENENIE DIOKSANSUL' FOTRIOKSIDA DLYA OPREDELENIYA AKTIVNOGO ATOMA VODORODA V SPIRTAKH I AROMATICHESKIKH AMINAKH]

A. P. Terent'ev and N. B. Kupletskaya Feb. 1964 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 90, no. 5, 1953 p 807–809
(TIL/T.5451)

When dioxane sulphur trioxide reacts with alcohols, a quantitative formation of esters takes place; primary and secondary amines give derivatives of sulphamic acid. Dioxane sulphur trioxide reacts with water to give sulphuric acid, which can be titrated with alkali on the usual indicators. Thus by back-titration of excess dioxane sulphur trioxide the amount reacting with the alcohol is estimated, yielding the number of hydroxyl groups. Numerous results are given. Author

N64-16553 Monsanto Research Corp., Everett, Mass. Boston Labs.

CATALYTIC HYDROCRACKING OF POLYPHENYL SYSTEMS FOR USE IN RECLAMATION OF ORGANIC NUCLEAR REACTOR COOLANT

D. A. Scola and R. Kafesjian Washington, AEC Div. of Tech. Inform., 30 Jun. 1963 115 p refs
(Contract AT(11-1)-705; Contract AT(10-1)-1088)
(MRB-6003T1; IDO-11056) OTS: $2.25

Laboratory studies were conducted to develop a catalytic hydrocracking method to reclaim degraded-terphenyl nuclear-reactor coolant. Conditions necessary for hydrocracking polyphenyls are described, along with a technical evaluation of the process and products. A preliminary economic evaluation of the various hydrocracking processes is presented. Author

N64-16555 International Union of Pure and Applied Chemistry, Basle (Switzerland) Commission on High Temperatures and Refractories
BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF GASES AND GAS-CONDENSED PHASE REACTIONS
L. Brewer, comp. (Calif. U.) 31 Dec. 1963 29 p refs
(Rept. 10)

The articles presented in this bibliography are in the following categories: (1) spectroscopy of interest to high-temperature chemistry; and (2) gas and gas-condensed phase reactions. I.v.L.

N64-16650 National Bureau of Standards, Washington, D.C.
SYNTHESIS OF DIATOMIC RADICALS
H. E. Radford 1 Feb. 1964 12 p refs
(Contract NAonr-16-64)
(NBS-8180; AD-430393)

The discovery of a systematic method of producing and maintaining cool, reasonably dense, gases with diatomic radicals is reported. Some preliminary data resulting from the method are presented. These data include discrete microwave spectra of the molecules SeH and TeH. P.V.E.

N64-16697 Sandia Corp., Albuquerque, N. Mex.
THE OXIDATION OF U(IV) BY Tl (III) OVER AN EXTENDED CONCENTRATION RANGE IN AQUEOUS-PERCHLORIC ACID SOLUTIONS
James O. Wear Jan. 1964 27 p refs
(SC-4972(RR)) OTS: $0.75

The kinetics of the oxidation of U(IV) by Tl(III) were examined in aqueous-perchloric acid solution with the concentration of U(IV) and Tl(III) varied over a 2,000-fold range. The orders with respect to U(IV) and Tl(III) were found to be different in different concentration ranges. The data have been explained using combinations of four paths involving hydrolytic species. The temperature has been varied from 15° to 50° C, and the activation energy has been found for each rate constant. Author

N64-16702* National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala.
CORRELATION OF PARTICLE COUNTS FOR MILLIPORE AND WHATMAN METHODS OF ANALYSIS
J. O. Romine and J. B. Gayle 21 Nov. 1963 17 p refs
(NASA TM X-54617; MTP-P&VE-M-63-16) OTS: $1.60 ph $0.80 mf

Results of particulate contamination analyses by the Millipore and Whatman methods have been correlated for samples representing a wide range of contamination levels. These data indicate that although the different types of filters afford approximately equal particle retention, the modes of retention are markedly different. The particles are retained almost exclusively on the surface of the Millipore filter; whereas, with the Whatman filter, some particles are retained on the surface, and some are embedded in the filter structure. There also appears to be a significant difference in the ease with which particles retained on the surfaces of these different types of filters can be distinguished microscopically. It therefore appears that any numerical equation relating the results obtained by these methods must be restricted to the particular type of contaminant present in the samples for which the equation was derived. Author

N64-16800 Oregon State U., Corvallis Science Research Inst.
VAPOR PHASE HYDROLYSIS OF PENTABORANE-9 Technical Documentary Report, 1 Jun. 1962-31 May 1963
G. W. Butler, T. D. Parsons, C. H. Wang, and D. J. Reed Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs. (6570th), Dec. 1963 15 p refs
(Contract DA-18-108-CML-7154)
(AMRL-TDR-63-129; AD-431220) OTS: $0.50

The hydrolysis of pentaborane-9 in the vapor phase was carried out at 85° and 150° C. The reactions carried out at 150° C were at initial pentaborane concentrations in a ratio of 10 to 1 with a constant water concentration. Since these reaction conditions gave initial rate constants in a ratio of 10 to 1, it was concluded that the vapor phase hydrolysis of pentaborane was initially first order in respect to pentaborane concentration. A proposed mechanism for the reaction suggests an initial hydrolysis of the terminal hydrogen atoms of pentaborane at a decreasing rate, followed by the rupture of the pyramidal boron framework and/or hydrolysis of the bridge hydrogen atoms at an accelerated rate. Author

N64-16841 Harvard U., Cambridge, Mass.
INVESTIGATIONS IN THE FIELD OF SILICON-NITROGEN COMPOUNDS, INCLUDING POLYMERS Technical Report
Dieter Kummer Jan. 1963 29 p refs
(Contract Nonr-1866(13))
(AD-432136) OTS: $2.60

Investigations in the field of silicon-nitrogen compounds, including polymers, continued in two directions: (1) the direct synthesis of silylamine polymers by the reactions of difunctional or polyfunctional chlorosilanes with other diamines, or by the reactions of amines and chlorosilanes of a structure that would prevent the formation of small-membered ring compounds; and (2) the preparation and investigation of other five-membered silylamine compounds that have a close structural relationship to the above-mentioned ring compounds, in order to obtain more information on the character of the Si-N bond in such compounds. In the light of (1) and (2), the reactions of o-phenylene diamine with different chlorosilanes and the reactions of p-(dimethylchlorosilyl) phenyl dimethylchlorosilane with different amines were investigated. I.v.L.

N64-16888 Stanford Research Inst., Menlo Park, Calif.
HIGH ENERGY OXIDIZERS IN SOLUTION Technical Progress Report No. 2-Quarterly, 1 Oct.-31 Dec. 1963
W. E. Tolberg and M. E. Hill 30 Jan. 1964 19 p
(Contract AF 04(611)-9370; ARPA Order 24)
(AD-430938)

Anhydrous hydrogen fluoride was prepared in conductimetrically pure form with a conductivity of 5×10^{-7}/ohm cm at 0° C; this value compares very favorably with accepted values of about 1.6×10^{-6}/ohm cm. Commercial NF_3 has been analyzed, and its purification was begun. Metal and plastic vacuum lines for preparing and observing interactions of NF- or OF-containing oxidizer gases in liquid HF have been completed. Author

08 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propogation. *For tracking stations see*: 10 Facilities, Research and Support. *For related information see*: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-16151 Institute of Electrical and Electronics Engineers, New York, N.Y. Professional Technical Group on Space Electronics and Telemetry
NEW LINKS TO NEW WORLDS, 1963 NATIONAL SPACE ELECTRONICS SYMPOSIUM
[1963] 54 p refs Record of a Symp. held at Miami Beach, Fla., 1-4 Oct. 1963

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38. A PRECISION RADAR FOR SPACE DOCKING AND RENDEZVOUS J. F. Marchese (Martin Co.) 6 p refs (See N64-16187 08-08)

39. A COHERENT SOLID-STATE RADAR FOR SPACE RENDEZVOUS AND PLANETARY LANDINGS J. L. Burrows and H. B. Goldberg (Lab. for Electron.) 18 p refs (See N64-16188 08-08)

40. THE OPTICAL RADAR FOR RENDEZVOUS AND DOCKING R. O. Leighou, E. Kirchoff, and R. B. Blizard (Martin Co.) 11 p ref (See N64-16189 08-08)

N64-16152* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A 3-POUND, 1,000-WATT X-BAND REENTRY TELEMETRY SYSTEM

R. F. Harrington, E. A. Brummer, and W. A. Southall *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 14 p refs (See N64-16151 08-08)

The X-band telemetry system described in this paper weighs 3 pounds, is small in size, can operate under accelerations greater than 100 g, and will be able to transmit high-rate data directly during the reentry blackout period from vehicles traveling at 25,000 fps or greater. As an example of the application of this reentry telemetry system a Trailblazer II payload installation is described, and the flight plans are reviewed. Author

N64-16153 Sandia Lab., Albuquerque, N. Mex.

HIGH-RESOLUTION TELEMETRY SYSTEM FOR DIAGNOSTIC ROCKETS

R. D. Jones, J. C. Mitchell, and R. G. Scharrer *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 9 p refs (See N64-16151 08-08)

(Sponsored by AEC)

A high-resolution rocket telemetry system for transmission of short-duration transient data was developed for use in the Dominic high-altitude test series. A 55 mc-bandwidth FM microwave telemetry channel (6 Gc) was established between diagnostic rockets in adverse radiation environments and a ground station over distances of the order of 10^5 meters. The telemetry link was maintained through radiation-induced ionized media. Author

N64-16154* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A MEDIUM DATA RATE DIGITAL TELEMETRY SYSTEM

Marjorie Townsend, Paul Feinberg, and John Lesko *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 12 p refs (See N64-16151 08-08)

Earth-orbiting satellites require onboard data storage. A suitable medium data-rate digital telemetry system with 10^7 bit storage is described. Since this storage is provided by a tape recorder, a unique technique for wow and flutter compensation was developed. Hardware applicable to the radiation experiments on the TIROS and Nimbus meteorological satellites has been built and is currently being tested. Author

N64-16155 Lockheed-California Co., Burbank

DRIFT– A C-BAND TELEMETRY SYSTEM FOR "POLARIS" RANGE TESTS

F. R. Zboril *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 9 p (See N64-16151 08-08)

Reentry and impact studies for the longer range missiles of Polaris A2 and A3 series were planned for 1962–1963. In preparation of the tests a microwave telemetry system was developed in an attempt to obtain real-time telemetry reception during reentry. Successful testing in the AMR verified the design of the system. A discussion of its concept is given. Author

N64-16156 Bell Telephone Labs., Inc., Murray Hill, N.J.

ELECTRONICS IN THE TELSTAR SATELLITE

R. C. Chapman and E. J. Reid *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 7 p refs (See N64-16151 08-08)

The telemetry and command portions of the TELSTAR system provide necessary support functions for the basic communications experiment and the radiation experiment. The telemetry system uses a VHF carrier to transmit encoded information from the satellite. Data on 112 items are provided once each minute. By means of the command system, the states of 9 magnetic latching relays in the satellite are controlled from the ground. Commands are sent to the satellite by coded signals modulated on a carrier, also in the VHF band. This paper describes the overall telemetry and command systems and discusses in some detail the design of the command decoder. It also describes the command malfunction of the first TELSTAR satellite and its subsequent recovery. A brief description of the operation of the second TELSTAR satellite is also included. Author

N64-16157 Hughes Aircraft Co., Culver City, Calif.

THE ADVANCED SYNCOM COMMUNICATION ANTENNA SYSTEM– A DIRECTIVE ARRAY FOR A SPIN-STABILIZED SATELLITE

H. R. Erhardt, G. Gerson and D. C. Mead *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 33 p refs (See N64-16151 08-08)

The Advanced SYNCOM Communication Antenna System approaches the optimum antenna pattern for a synchronous satellite while maintaining the control system simplicity of spin stabilization. This pattern, a cone which just covers the earth, is achieved by the use of a 16-element phased array. The beam, which is used for transmitting from the satellite to the earth, is held stationary in earth-satellite coordinates by electronically spinning the beam at spacecraft spin speed, in a direction opposite to spacecraft rotation. For the power levels used in the SYNCOM system, the power put into the phased array control circuits gives an increase in effective radiated power that is an order of magnitude greater than could be obtained by putting the same power directly into the transmitters. Author

N64-16161 Radio Corp. of America, New York, N.Y.

TECHNIQUES FOR DIGITAL COMMUNICATION VIA SATELLITES

F. Assadourian and E. M. Bradburd *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 8 p refs (See N64-16151 08-08)

Synchronization techniques are treated for digital transmission over subsynchronous and synchronous satellite links that form a part of general communication networks interconnecting several nodes that perform multiplexing functions. The primary emphasis is on bit synchronization and identification on a link basis. A bit transport equation is developed to relate numbers of transmitted and received pulses, with variable path delays taken into account. When differences between clocks at the ends of a link are included, the result is useful in determining storage requirements for time buffering that can be inserted to maintain bit synchronization. In the case of subsynchronous satellites, handover techniques are discussed for the preservation of bit integrity during switching from one satellite to the next. Author

N64-16162 Martin Co., Orlando, Fla.
LOW-LEVEL SATELLITE COMMUNICATIONS USING RACEP
H. W. Grossman *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 7 p (See N64-16151 08-08)

Studies and analyses conducted during the past several years in the area of random access and multiple access communications have indicated that frequency-time coded pulsed communication techniques offer advantages in power and bandwidth efficiency and in system flexibility over conventional approaches to solutions to military communications problems. Antijam characteristics are comparable to or better than conventional modulation techniques. This document presents the concept for a military satellite communication system using RACEP techniques. This system offers random-multiple communication access to a satellite relay without the use of a central preprograming control facility. Author

N64-16163 Philco Corp., Philadelphia, Pa.
RANDOM ACCESS STATIONARY SATELLITE RELAY COMMUNICATION SYSTEM
Z. Prihar *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 21 p ref (See N64-16151 08-08) (PCE-R-1152-0020A, condensed)

The paper discusses a method of operation of a random access communication system via active stationary satellite relays. Following a discussion of the proposed instructions and their flow, the operation of the Control Center is analyzed. Two service channel transmission speeds have been considered—50 bits per second and 1,200 bits per second. Using an assumed list of channel requirements, the predicted number of service channels has been computed. Queuing (waiting line) problems have also been considered. Following a critique of the random access technique, alternative multiple access methods are discussed, and a substitution of an adaptive system is proposed for optimal performance. Author

N64-16164 General Electric Co., Philadelphia, Pa. Re-entry Systems Dept.
AN ADAPTIVE DATA SAMPLING SYSTEM
M. Berkowitz *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 20 p refs (See N64-16151 08-08)

This paper describes an adaptive data-sampling system that tests the change in signal level of each data channel, from one sample to the next, against a priori, preprogramed criteria, and that utilizes the result of this test to limit the system output to only significantly changed data. It is shown that the amount of oversampled data is thus significantly reduced, as seen at the system output, resulting in varying amounts of time being liberated depending upon the properties of the signals being sampled. Results obtained with a rudimentary scale model of the system are briefly described, and the steps required to generate a full-scale design are considered. The use of microelectronic techniques to accomplish sophisticated operations of this type is illustrated by describing a newly designed microelectronic multiplexer. Author

N64-16165 Radio Corp. of America, Burlington, Mass. Aerospace Communications and Controls Div.
A MINIATURE MAGNETIC MODULATOR MULTIPLEXER
Marshall C. Kidd and Alan G. Atwood *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 18 p refs (See N64-16151 08-08)

A feasibility model of a miniature magnetic modulator multiplexer system has been built and successfully tested. New techniques developed during the investigation permit the extension of magnetic modulator-amplifiers to high-speed low-level commutating applications. The restriction of the input circuit bandwidth on the maximum switching speed has been eliminated. These improvements have been accomplished by the use of excitation switching on each modulator instead of signal switching, as is normally done. Also, a unique digital drive selection system is used that makes the modulators highly insensitive to excitation fluctuations of amplitude and frequency normally associated with analog drive. The inherent stability of the magnetic modulator with the addition of overall feedback should make this system more accurate than a transistor multiplexer-amplifier configuration. Author

N64-16166 Ampex Corp., Redwood City, Calif.
TRANSIENT-FREE AND TIME-STABLE SIGNAL REPRODUCTION FROM ROTATING HEAD RECORDERS
Erhard Kietz Jul. 1963 *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 26 p refs (See N64-16151 08-08)

General considerations are given concerning improvements with respect to time-base stability on rotating-head recorders that scan the tape in a direction perpendicular to the tape motion. Experiences and results are described of the development of an improved radar and telemetry pulse-recording system that provides a timing accuracy of ±10 nanoseconds with respect to a standard reference frequency. Any spurious signals or head switching transients are suppressed to a level well below the system noise. The general problem of time-base stability in magnetic recorders is surveyed. Transient-free signal reproduction is discussed. Methods are described for the demonstration of transients and signals instabilities originating in other parts of the recording system. Author

N64-16167 Lockheed Missiles and Space Co., Sunnyvale, Calif.
A SYSTEM ORIENTED PCM GROUND STATION INCORPORATING DATA COMPRESSION
L. J. Lauler *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 15 p (See N64-16151 08-08)

Pulse code modulated signals for telemetry allow the transfer of tremendous quantities of data with variable resolution and extreme flexibility in data rates and number of channels. The large quantities of data acquired, especially by satellite missions, has accelerated the trend toward data handling automation, and an increasingly popular trend has been the

incorporation of on-line, small general purpose digital computers in data reduction systems. This trend has led to a re-examination of data conversion equipment design in the context of compatibility with computer control. This paper presents the design of a PCM decommutation system utilizing a core memory for program storage. Emphasis is placed on the systems aspect of the design, particularly the solution of the problems associated with on-line computer operations. Author

N64-16172 Naval Research Lab., Washington, D.C.
RADIO INTERFEROMETER PHASE-CHANNEL COMBINER, MOD. II FOR THE NAVY SPACE SURVEILLANCE SYSTEM
M. G. Kaufman *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 14 p refs (See N64-16151 08-08)

The purpose of this report is to describe an electronic system that automatically combines several noisy ambiguous radio interferometer phase channels into one unambiguous quiet channel. With this system, a multibaseline radio interferometer system, normally having high angular resolution capability accompanied with the usual interferometer ambiguity problem associated with deciphering the multiple phase signal outputs, can be instrumented directly into a single unambiguous signal output that has an accuracy and resolution proportional to the longest baseline in the interferometer and whose noise content is inversely proportional to this baseline. Author

N64-16176* National Aeronautics and Space Administration, Washington, D.C.
COMMUNICATIONS AND TRACKING ON THE APOLLO LUNAR EXPLORATION MISSION
Samuel W. Fordyce *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 13 p (See N64-16151 08-08)

Unlike the explorers of the earth, the lunar explorers can be in almost continuous communication with their home base. This paper contains a description of the communication links under development for this purpose. They include links for radar tracking, voice communications, telemetry, and an up-data or command link. The communication links used on Apollo consist mainly of equipment that has been tested and proven on previous space flights. In some cases the equipment, trajectories, and operational doctrines described are still under study and may be changed prior to the lunar mission. Author

N64-16177 Collins Radio Co., Cedar Rapids, Iowa
THE APOLLO TELECOMMUNICATIONS SYSTEM
S. E. Watson and W. S. Pope (N. Am. Aviation) *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 27 p refs (See N64-16151 08-08)

For use during operations within a few thousand miles of the surface of the earth, the Apollo spacecraft contains a VHF-FM transmitter for down transmission of data and a C-band transponder as an aid to earth-based radar tracking. Utilized during both near-earth operations and lunar journeys are an intercom, signal conditioners, a PCM telemeter, and data storage equipment. Once the spacecraft has traveled more than a few thousand miles from earth, all communications are maintained through the use of a phase-coherent unified S-band transponder and an associated power amplifier. This transponder receives and retransmits pseudorandom noise ranging signals, receives voice and up data, and transmits telemetry, voice, stored data, and television. To aid in recovery of the spacecraft, an HF single-sideband transceiver and a VHF recovery beacon are employed. Author

N64-16178 Avco Corp., Cincinnati, Ohio Electronics Div.
PERFORMANCE CHARACTERISTICS OF ERROR-LOCATION CODES FOR A SPACE PROBE TELEMETRY SYSTEM
C. P. Carpenter and H. E. Rhody *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 11 p refs (See N64-16151 08-08)

A preliminary performance study of a new class of codes that combine error location with error correction is presented. Specific examples are given that are applicable to three different types of communication systems. Curves for word error rate and channel capacity are included. Author

N64-16180* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
AN EFFICIENT PCM ERROR CORRECTION AND SYNCHRONIZATION CODE
Marvin S. Maxwell and Richard L. Kutz *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 16 p refs (See N64-16151 08-08)

The probability of frame synchronization as a function of single bit error probability is shown. Additional error correction information may be obtained if the voltage from the bit integrator is used with an error detecting code. The equivalent gain in signal-to-noise ratio, made by using the additional error correction method, is discussed. A proposed ground station to process the data is discussed. Author

N64-16181 Sylvania Electric Products, Inc., Waltham, Mass.
APPLICATION OF VLF TO INTERPLANETARY COMMUNICATIONS
J. Farber and G. Biernson *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 14 p refs (See N64-16151 08-08)

The application of VLF to interplanetary communications is reviewed. Paramount to the success of a VLF relay satellite is a method whereby the physically large antenna aperture can be erected in outer space. Because communication is desired in the plane of the ecliptic, a simple dipole antenna will provide the required omniazimuthal coverage. Techniques for erecting and maintaining the shape of the long antenna are considered, and a practical design is presented. Although the VLF communication system appears very promising, the estimates of the transmission characteristics are based on very incomplete data. However, the potential system advantages are great, the most significant being low power, long-haul point-to-point capability, the omnidirectional antenna characteristics, and the relaxation of frequency search and tracking requirements. The feasibility of the communications concept depends critically on the VLF noise levels in interplanetary space. A preliminary analysis indicates the potential existence of VLF attenuation around the earth (and around the sun). I.v.L.

N64-16182* National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.
INTER-PLANETARY MISSION COMMUNICATION SYSTEMS
Ralph S. Sawyer *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 13 p (See N64-16151 08-08)

The four major functions of communication and tracking systems for interplanetary missions—tracking, data acquisition and transmission, voice communication, and television—are discussed. An outline is given of some of the advanced techniques that are currently being pursued; of these techniques, optical communication systems, nonvoice low data rate communication systems, and bandwidth compression offer the greatest potential of assisting in the solution of manned interplanetary communication problems. Author

N64-16183 Cutler-Hammer, Inc., Deer Park, N.Y. Medical and Biological Physics Dept.

A PROTOTYPE SELECTIVE MONITORING SYSTEM FOR PHYSIOLOGICAL DATA

George W. Morton and Miles A. Mc Lennan (Aerospace Med. Div.) *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 16 p (See N64-16151 08-08)
(Contract AF 33(657)-10462)

This paper describes the development and application of selective monitoring techniques to extract the significant information from data typical of that originating in a manned space vehicle. Use of these techniques substantially reduces the load on all portions of the transmission and analysis facilities. Of even greater importance is the potential saving in weight and power consumption of onboard telemetry equipment. Author

N64-16185 Bendix Corp., Southfield, Mich. Research Labs., Div.

A HIGH-RESOLUTION SYSTEM FOR LUNAR AND PLANETARY LANDING-SITE SELECTION

J. C. Dawson and W. N. Gamber *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 8 p (See N64-16151 08-08)

A concept is presented for a radar–computer system that permits selection of a satisfactory vehicle landing site during the terminal descent phase of a lunar or planetary exploration mission. The concept combines a high-resolution radar with a special processor that operates on the signals from parallel narrow-band receivers to provide a means of closely examining the proposed landing area and of selecting a suitable section for touchdown. The system would be capable of surveying an area 500 by 500 ft from a nominal vehicle altitude of 1,000 ft, in less than 30 sec of hover time, and of determining the presence of surface irregularities (boulders or crevices) that vary more than 3 ft from the average level. Smooth slopes of 5° or more could also be determined. Author

N64-16186 Emerson Electric Mfg. Co., St. Louis, Mo. Electronics and Space Div.

AN FM-CW RADAR SENSOR FOR SPACE VEHICLE RENDEZVOUS AND LANDING

Jack Hooper and Harold Sullivan *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 6 p refs (See N64-16151 08-08)

This paper describes a laboratory FM-CW radar. A unique FM-CW orbital rendezvous and landing radar system is presented, and it is shown that the techniques developed for the laboratory radar can be utilized in the development of the space sensor. Author

N64-16187 Martin Co., Baltimore, Md. Electronic Systems and Products Div.

A PRECISION RADAR FOR SPACE DOCKING AND RENDEZVOUS

J. F. Marchese *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 6 p refs (See N64-16151 08-08)

The precision radar described in this paper transmits a 1-nanosecond pulse with a spectral width on the order of 1 gigacycle, enabling a range resolution and a range accuracy of less than 6 inches. The pulse generator, a completely solid-state avalanche device contained in a 1-cubic-inch brass box, generates a 50-volt pulse with a rise time of 0.3 nanosecond and a pulse width of 1 nanosecond at the half-power points. This pulse is used to switch a microwave diode mounted in the X-band waveguide that is capable of providing a 27-db switching ratio with a 0.5-db insertion loss. A technique is described that will enable processing of the range information contained in the video pulse. A technique for extending the maximum range of the device without perturbing the range resolution is accomplished through use of a pseudorandom code modulated waveform and appropriate matched filter processing. A method of generating these codes and a discussion of the matched filter, as well as the autocorrelation function of the coded wave form, are presented. Author

N64-16188 Laboratory for Electronics, Inc., Boston, Mass.

A COHERENT SOLID-STATE RADAR FOR SPACE RENDEZVOUS AND PLANETARY LANDINGS

Harold B. Goldberg and James L. Burrows *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 18 p refs (See N64-16151 08-08)

This paper describes an all-solid-state Doppler radar design that will provide accurate navigational inputs for both landing and rendezvous missions in space operations. The functionally integrated system weighs only 34 pounds, uses the same antenna, transmitter, range, and velocity circuits for both missions, and incorporates highly reliable components, proven circuits, and a packaging design compatible with the severe environmental conditions of launch-into-space and of space itself. Author

N64-16189 Martin Co., Denver, Colo.

THE OPTICAL RADAR FOR RENDEZVOUS AND DOCKING

E. Kirchhoff, R. O. Leighou, and R. B. Blizard *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 11 p refs (See N64-16151 08-08)

An optical (visible light) radar system is described that will provide the relative position data necessary for enacting a space rendezvous between two vehicles. The operation of the system is described, and calculations are given showing the maximum ranges attainable under conditions of dark background and of illuminated earth background. Test data on the operating prototype are noted, illustrating the capability of operating down to a 1-m range with high angular resolution. Author

N64-16421 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON CONDITIONS OF RADIO COMMUNICATION IN HIGH AND MIDDLE LATITUDES

Ye. Ye. Goncharova and M. V. Kiseleva 28 Jun. 1963 18 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 3, no. 1, 1963 p 94–103
(FTD-TT-63-443/1+2+4; AD-413048)

It has been shown that prolonged communication breakdowns have been observed during strong magnetoionospheric disturbances. Breakdowns in communication were observed on long radio links even when the ionosphere was in a quiet state. The possibilities for radio communication at high frequencies through reflection of radio waves from the sporadic E_s layer are examined. Author

N64-16429 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

RADAR VECTORING OF FIGHTER AIRCRAFT

W. Delawski 12 Jun. 1963 21 p Transl. into ENGLISH from Wojskowy Przeglad Lotniozy (Warsaw), v. 17, no. 2, 1963 p 11–23
(FTD-TT-63-606/1+2; AD-412796)

The topics discussed include: (1) the nature of providing radar vectoring for fighter aircraft; (2) principles of vectoring

fighter aircraft toward aerial targets; (3) automatic vectoring; and (4) radar confirmation of fighter activities when combating fast and group targets at low and high altitudes. R.T.K.

N64-16447 Aerospace Corp., El Segundo, Calif.
FUNDAMENTAL ACCURACY LIMITATIONS FOR PILOT-TONE TIME-BASE CORRECTION
Jean A. Develet, Jr. 10 Feb. 1964 13 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-9; TDR-269(9990)-3; AD-430464)

Wiener filtering concepts are applied to the problem of determining the accuracy limitations for a pilot-tone time-base correction system. In this system, the correction is accomplished by the addition of a stable sinusoid in a clear area of the signal baseband. After transmission through a medium with varying time delay and additive noise, the pilot tone is recovered by a tracking filter. The output of the tracking filter can be used to estimate the variations in time delay of the transmission medium. A statistical optimization is then performed to find the minimum residual time-base error in the desired signal after correction by such a system. Author

N64-16461 Library of Congress, Washington, D.C. Aerospace Information Div.
TRANSMITTING SATELLITE PROPAGATION STUDIES, COMPILATION OF ABSTRACTS
5 Feb. 1964 11 p refs
(AID-P-64-9; AD-429775) OTS: $1.60 ph, $0.80 mf

Four articles treat different aspects of the investigation of charged particles in the ionosphere by the Cosmos-3 and Cosmos-5 satellites: (1) a detailed description of the particle-sensing apparatus carried onboard; (2) evidence of the existence of currents of electrons and positive ions in the upper ionosphere, having energies that are relatively low but greater than the thermal energy; (3) a description of the high-energy particles registered by Geiger counters; and (4) deductions of atmospheric density based on observed decelerations of the satellites as they passed through their perigees. A fifth article describes calculations made on variations in electron density in the upper atmosphere based on the Doppler shift behavior of two simultaneous signals transmitted from the Cosmos-1 and Cosmos-2 satellites. A sixth article describes equipment carried on Cosmos-2 and Cosmos-7 satellites to measure radiation along the routes of the proposed Vostok-3 and Vostok-4 flights. R.L.K.

N64-16462 Library of Congress, Washington, D.C. Aerospace Information Div.
TRANSMITTING SATELLITE PROPAGATION STUDIES, COMPILATION OF ABSTRACTS
23 Jan. 1964 19 p refs
(AID-P-64-5; AD-430473) OTS: $1.60 ph, $0.80 mf

Abstracts of five articles are given. Topics discussed include coherent receiving apparatus for recording Doppler shift differences in radio transmissions from artificial earth satellites, radio investigation of the ionosphere by means of Cosmos satellites, altitude distribution of charged particles in the ionosphere, geophysical studies made with Cosmos satellites, and characteristics of geoactive particles. A comprehensive chart of Cosmos series flight data is included. E.W.

N64-16655 Aerospace Corp., El Segundo, Calif. Telecommunications and Tracking Dept.
HARD LINE VS MICROWAVE LINK TRADE-OFF STUDY. VAFB/NMFPA DATA TRANSMISSION SYSTEM
R. P. Mc Garrity Jan. 1964 20 p
(Contract AF 04(695)-269)
(TOR-269(4110-03)-2; AD-431743)

This tradeoff study of hard line links vs microwave links lists the advantages and disadvantages of each type of link in regard to security, electromagnetic interference, data quality, reliability, total bandwidth capacity, single-channel bandwidth-capacity hardness, flexibility, and link length. A comparison of the costs of the two systems indicates that both hard line and microwave systems can be fruitfully employed in the Vandenberg Air Force Base–Navy Missile Facility Point Arguello communication system. This conclusion, however, could be upset by a shift in the required data-handling capacity or by the imposition of additional requirements. It would, for example, be costly to provide TV transmission via cable runs. For cable length runs of 11 and 15 miles, the overhead hard line system is 101% and 90% more expensive, respectively, than the microwave system. For runs of 5 to 8 miles, the cost of an overhead wire system becomes approximately equal to the cost of the microwave system. For even shorter distances, the microwave system is the more expensive system. I.v.L.

N64-16656 Stanford U., Calif.
LARGE-SAMPLE ESTIMATION OF AN UNKNOWN DISCRETE WAVEFORM WHICH IS RANDOMLY REPEATING IN GAUSSIAN NOISE
Melvin Hinich 31 Dec. 1963 47 p refs
(Contract Nonr-225(52))
(Tech. Rept. 93; AD-429465)

An analysis was conducted to estimate the waveform of an input X(t) that is repeated randomly, and is embedded in the Gaussian noise with a known covariance function. The rate of recurrence of the waveform is a small constant, and the signal-to-noise ratio of the input is quite low. An estimation is also sought of the waveform's autocorrelation. A formal statement of this problem and its description are given. A statement is also given of the Cramer–Rao Theorem, and the information matrices relevant to the estimation of the waveform and its autocorrelation are derived along with their inverses. The optimal estimator of autocorrelation is presented, and it is shown that although the normalized sample correlation is an unbiased estimator of autocorrelation, it is not sufficient. Three examples discussed are the general case of white noise, the case of white noise when the discrete waveform has only two components, and the case of Gaussian Markov noise. The problem of estimating the waveform after the autocorrelation has been estimated is discussed. C.L.W.

N64-16724* Smithsonian Astrophysical Observatory, Cambridge, Mass.
ON THE VISUAL TRACKING OF TWO BRIGHT SATELLITES FROM C-130-TYPE AIRCRAFT **Research in Space Science**
Richard C. Vanderburgh 24 Feb. 1964 22 p refs
(NASA Grant NsG-4am; NASA Grant NsG-563)
(NASA CR-55905; SAO Special Rept. 146) OTS: $2.60 ph, $0.86 mf

In order to determine the general feasibility of airborne visual satellite tracking, five flights were made aboard USAF C-130 aircraft. These were part of a preliminary study toward the development of a reliable and economic means of tracking low, unstable satellites. The targets in this study were the two bright balloon satellites, 1961 Delta 1 (Explorer IX) and 1960 Iota 1 (Echo I). The military model of the Kolsman Periscopic Sextant 1287 series was the optical instrument used on all flights. This instrument, normally used in celestial navigation, is standard equipment aboard commercial and military aircraft flying overseas. R.T.K.

N64-16770* Hughes Aircraft Co., Culver City, Calif. Aerospace Group

STUDY ON OPTICAL COMMUNICATIONS FROM DEEP SPACE Interim Progress Report, 27 Mar.-31 May 1963

Kenneth L. Brinkman [1963] 77 p refs

(NASA Contract NAS9-879)

(NASA CR-55812; SSD-3340R) OTS: $7.60 ph, $2.51 mf

A system-design analysis is performed for the deep-space vehicle-to-earth link, using simple quantum detection. The effects of atmospheric turbulence on the selection of system-design parameters are discussed as are the considerations concerning site selection in order to avoid the problem of interfering weather and cloud cover. Two different systems were chosen for analysis—a pulsed laser using PPM, and a continuous-wave laser using PCM with polarization modulation. A comparison between the two systems shows a strong bias toward PPM systems in a low-noise environment; as the noise increases, the PCM system very likely takes precedence. Thus, the system noise plays a significant role in the optimum-system selection. I.v.L.

N64-16803 Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.

ON THE STABILITY ANALYSIS OF A TWO-WAY CONTROLLED CARRIER TRANSMISSION SYSTEM

Neil J. Bershad Dec. 1963 16 p refs

(AFCRL-63-586; AD-428435)

A mathematical model of a linear controlled-carrier tropospheric communication system is analyzed for tropospheric gain variations with a white-noise power spectral density. The stability of the first moment of the impulse response of the closed-loop control system is determined as a function of the linear controllers and the statistical characteristics of the troposphere. Author

N64-16877 Aerospace Corp., Patrick AFB, Fla.

STATISTICAL STUDY TO ASCERTAIN THE VALIDITY OF THE AMR RADIO CIRCUIT PERFORMANCE SUMMARIES FOR HF RADIO OUTAGE

J. L. Bagg 29 Feb. 1964 32 p

(Contract AF 04(695)-269)

(TOR-269(A4306)-6; AD-430925)

Upon examining the RCA Radio Circuit Performance Summaries for the first 8 months of 1963, it was concluded that these summaries make it appear that outage due to frequency fade or propagation difficulties was not randomly distributed for an extended time period. It is contended that outage is more likely to be recorded during a period near launch time when circuit monitoring and traffic are heavy. To support this contention, available data for the P13D, P13U, and P26D transmission links were examined. The data examined were the number of quarter-hour outages in various time intervals before and after the launch times and also before and after a set of pseudolaunch times. This included a study of 27 launches and 25 pseudolaunches. In general, the statistical analysis substantiated the contention that monitoring is heavier near launch time than between launches; consequently, studies based upon the RCA Radio Circuit Performance Summaries undoubtedly are biased. Author

09 ELECTRONICS

Includes circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory. *For related information see*: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation and Photography; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N64-16130 Cornell U., Ithaca, N.Y. School of Electrical Engineering

THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF LINEAR-BEAM MICROWAVE TUBES, VOLUME I Final Report

Griffiss AFB, N.Y., RADC, Dec. 1963 199 p refs

(Contract AF 30(602)-2573)

(RADC-TDR-63-518, Vol. I; EE-575; AD-429793)

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N64-16133 Cornell U., Ithaca, N.Y. School of Electrical Engineering

INVESTIGATION OF SMALL-SIGNAL R-F MODULATION ON D-C SCALLOPED BRILLOUIN BEAM

M. Roberts *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 25–53 refs (See N64-16130 08-09)

The first gun built for this project produced a spiralling beam, apparently caused by a mechanical warping of the magnetic material, leading to a magnetic field warp. Although this gun was remachined to ensure centering of the cathode structure, it was not possible to rework the anode where the magnetic path is most critical. The second gun built also produced a spiralling beam. This gun, however, was mechanically "perfect," eliminating a possible misalignment problem. Removal of the ball-valve parts without any resulting change in spiral amplitude proved that the electric field was not asymmetric and did not cause the spiral. Electromagnetic degaussing decreased the spiral amplitude, but did not entirely eliminate it. Since the only parameter found to control the spiral has been

associated with the magnetic field in the cathode–anode region, it is possible that the remaining spiral is caused by some inhomogeneity in the magnetic material of the gun. Author

N64-16134 Cornell U., Ithaca, N.Y. School of Electrical Engineering
DRIVE-INDUCED CURRENT MINIMA IN VELOCITY-MODULATED BRILLOUIN BEAMS
A. S. Gilmour *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 54–70 refs (See N64-16130 08-09)

It has been shown that at large-signal levels, there are axial positions in Brillouin beams where the current in the center of the beam is 180° out of phase with that at the edge of the beam. In addition, if the signal level is high enough, the RF current completely disappears in both the radial and axial directions in the beam. Both of these phenomena were shown to be the result of electron overtaking. Author

N64-16135 Cornell U., Ithaca, N.Y. School of Electrical Engineering
EFFICIENCY ENHANCEMENT AND VELOCITY-FILTER STUDY
Cheng Sun *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 74–95 refs (See N64-16130 08-09)

An attempt to increase the efficiency of klystrons by circulating RF power into the output gap of a two-cavity klystron is described. It is hoped that by increasing the efficiency, the velocity of the fastest electron will also be reduced. Then the arrangement can be used as a velocity filter. P.V.E.

N64-16136 Cornell U., Ithaca, N.Y. School of Electrical Engineering
NANOSECOND PULSE STUDY
In its Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 95a–95c (See N64-16130 08-09)

A short summary is presented of studies carried out on the problems associated with the use of high-power microwave amplifiers to amplify very short pulses (pulse lengths that are less than one hundred cycles of the RF carrier frequency). P.V.E.

N64-16137 Cornell U., Ithaca, N.Y. School of Electrical Engineering
A PHENOMENOLOGICAL ANALYSIS OF THE PULSE RESPONSE OF MICROWAVE AMPLIFIERS
P. R. Mc Isaac *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 96–131 refs (See N64-16130 08-09)

The analysis attempts to provide a basis for predicting some of the characteristics of the pulse response of microwave amplifier tubes. The pulse response of a nonlinear, finite-bandwidth amplifier may be predicted by the proposed method of analysis. The analysis provides qualitative, and some quantitative, predictions concerning the short-pulse response of microwave amplifiers that are otherwise unobtainable. The results of the analysis indicate that the band-limiting properties of a microwave amplifier are more important in controlling the pulse response than are the nonlinear saturation properties. The most important parameter is $N\Delta$ (the number of RF cycles in the input pulse times the normalized bandwidth of the amplifier). For $N\Delta$ greater than 10, there is very little pulse distortion due to band limiting. As $N\Delta$ decreases below 1.0, the pulse distortion increases rapidly, and the output pulse lengthens and decreases in amplitude. P.V.E.

N64-16138 Cornell U., Ithaca, N.Y. School of Electrical Engineering
THE CAPTURE EFFECT IN A DRIFTING ELECTRON BEAM
P. R. Mc Isaac *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 132–151 ref (See N64-16130 08-09)

In order to study the basic causes of the capture effect, an analysis was made of the effects of two simultaneous, modulating frequencies on a drifting electron beam. The analysis indicated that the main features of the capture effect are due to the basic nonlinear interactions within an electron beam. It also indicated that the capture effect should be noticeable whenever the combined input-signal level of the two frequencies is no longer negligible compared to the saturation drive level of a single frequency signal. The analysis indicated that the capture effect is quite sensitive to the frequency separation of the two signals. Other things being equal, the lower frequency signal will dominate the electron beam and tend to suppress the higher one. The larger the frequency separation, the greater the suppression of the higher frequency signal will be. The frequency sensitivity predicted by the analysis indicated that the capture effect should be noticeable in any linear-beam amplifier with a bandwidth spread of the order of 10 percent or more of the average frequency. P.V.E.

N64-16139 Cornell U., Ithaca, N.Y. School of Electrical Engineering
SHAPING OF KLYSTRON RESPONSE FOR NANOSECOND APPLICATIONS
F. Einaudi *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 152–168 ref (See N64-16130 08-09)

The results of an investigation into the influence of certain parameters on the output power of a two-gap klystron are presented. The formula used in the investigation expresses the output power in terms of the source and load admittances, the gap susceptance, the beam parameters, and the source level. P.V.E.

N64-16140 Cornell U., Ithaca, N.Y. School of Electrical Engineering
EXPERIMENTAL STUDY OF NANOSECOND PULSES
C. Heim *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 169–173 ref (See N64-16130 08-09)

A description is given of the modification, testing, and assembly of equipment to be used in investigating the pulse distortion of the output signal (of a klystron) as a function of input drive level, input pulse length, cavity tuning, and cavity loading. P.V.E.

N64-16141 Cornell U., Ithaca, N.Y. School of Electrical Engineering
MEASUREMENT OF NOISE IN POWER-PERVEANCE ELECTRON BEAMS
B. K. Andal *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 174–183 refs (See N64-16130 08-09)

A summary of work done in investigating the noise behavior of electron beams with a perveance in the range of those being used in current microwave devices is presented. P.V.E.

N64-16142 Cornell U., Ithaca, N.Y. School of Electrical Engineering
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF LINEAR-BEAM MICROWAVE TUBES, VOLUME II
Final Report

Griffiss AFB, N.Y., RADC, Dec. 1963 188 p refs
(Contract AF 30(602)-2573)
(RADC-TDR-63-518, Vol. 2; AD-429536)

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2. INVESTIGATION OF NEW CONCEPTS FOR MICROWAVE POWER GENERATION: A STUDY OF THE PI MODE OF THE DOUBLY RE-ENTRANT KLYSTRON CAVITY J. E. Goell 82 p refs (See N64-16144 08-09)

N64-16143 Cornell U., Ithaca, N.Y. School of Electrical Engineering

INVESTIGATION OF NEW CONCEPTS FOR MICROWAVE POWER GENERATION: EXPERIMENTAL INVESTIGATION OF AN EXTENDED-INTERACTION RING-ROD RESONATOR Report A

R. P. Zimmer 18 Oct. 1963 *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. II Dec. 1963 106 p refs (See N64-16142 08-09)
(Contract AF 30(602)-2833)
(Tech. Rept. 26; EE-577)

This report describes an experimental investigation of an L-band resonated slow-wave structure, the ring-rod resonator, which is used as an output cavity in a two-cavity klystron amplifier. Cold-test and hot-test data are presented. Studies are made of saturation efficiency and self-oscillation as functions of drift distance, beam voltage, and other parameters. The structure is suitable for high-power use if oscillations are suppressed, construction simplified, and coupling technique improved. It is potentially a high-efficiency device, capable of handling high powers with relatively low gap voltages. Under these conditions, it shows an appreciable increase of bandwidth over the classical reentrant cavity. Author

N64-16144 Cornell U., Ithaca, N.Y. School of Electrical Engineering

INVESTIGATION OF NEW CONCEPTS FOR MICROWAVE POWER GENERATION: A STUDY OF THE PI MODE OF THE DOUBLY RE-ENTRANT KLYSTRON CAVITY Report B

J. E. Goell 30 Jun. 1963 *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. II Dec. 1963 82 p refs (See N64-16142 08-09)
(Contract AF 30(602)-2833)
(Tech. Rept. 25; EE-563)

Interaction equations were developed for a gap with arbitrary field distribution, assuming linear operation. These equations were applied to typical fields of square, sinusoidal, and half-sinusoidal spatial distribution to obtain the behavior of cavity gaps with fields roughly approximating these shapes. The equations were also applied to a gap with an electric field distribution that is sinusoidal, but has its second peak reduced. These equations showed that the beam loading was strongly dependent on the cavity field distribution. The effect of moving a klystron gap longitudinally off center toward the end wall was investigated, and it was shown that monotron oscillations caused by the π mode could be eliminated. The possibility of using the π mode for klystron interaction was also investigated. Author

N64-16158 Electro-Mechanical Research, Inc., Sarasota, Fla.

A REALISTIC PART SCREENING PROGRAM FOR IMPROVING THE RELIABILITY OF SPACE ELECTRONIC EQUIPMENT

A. L. Heydrick *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 5 p (See N64-16151 08-08)

This paper defines the tests performed, test conditions, accept–reject criteria, and critical parameters to be monitored for each part type. It also includes a procedure for statistical analysis of recorded data and application of accept–reject criteria. Author

N64-16159 Cutler-Hammer, Inc., Deer Park, N.Y. Airborne Instruments Lab.

DESIGN OF A THIN-FILM LOG IF AMPLIFIER

R. Leslie *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 13 p refs (See N64-16151 08-08)

A unique circuit design has permitted thin-film modular fabrication of a 60-Mc logarithmic amplifier operating on the successive-detection principle. The thin-film modules consist of seven stages, one preamplifier, and one video amplifier. The most significant feature of the log stage is a differential arrangement that eliminates transformers and tuning inductors. The amplifier, which occupies 4 cubic inches, represents a 20:1 size reduction over previous amplifiers with identical performance. Author

N64-16160 Radiation, Inc., Melbourne, Fla. Product Design Section

PACKAGING OF AIRBORNE MULTIPLEXER-ENCODER PCM TELEMETRY SYSTEM

B. H. Singletary and C. T. Little *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 21 p (See N64-16151 08-08)

This paper describes the design, construction, and environmental testing of the mechanical packaging used on an Airborne Multiplexer-Encoder PCM Telemetry System. The system was designed and built for use on the Titan III missile program. It weighs 29.8 pounds, occupies a volume of 820 cubic inches, and consumes 8 watts of power at 28 vdc. Author

N64-16168* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

DETECTION AND MEASUREMENT OF CYCLE SKIPPING AND PHASE OFFSETS IN FREQUENCY MULTIPLYING PHASE-LOCK FILTERS

J. R. Young (Interstate Electron. Corp.), E. D. Reamer, and R. Craft *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 14 p (See N64-16151 08-08)
(NASA Contract NAS8-2657)

Third-order phase-lock tracking filters multiply incoming frequencies by 100 to improve Doppler and cyclic data digitizing resolution and to increase data rates in the 10-channel Redstone Cycle Counter, RCC-3. Because frequency multiplication also multiplies instantaneous phase errors, the resolution advantage may be lost unless supplementary techniques are used to detect and compensate errors in the digitized frequency data. Theoretical analysis, confirmed by experiment, shows that instantaneous phase errors and momentary cycle skipping may be detected and measured with sufficient accuracy to be used for automatic data editing and smoothing. Records of loop phase excursions during cycle skipping are provided to illustrate the practicability of automatic error correction. Author

N64-16179 Martin Co., Orlando, Fla.
LUNAR BASED ANTENNAS
Malcolm A. Stephens *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 4 p refs (See N64-16151 08-08)

The effect of environment on lunar-based antennas is examined. Of particular interest are the problems created by the absence of an atmosphere. Cosmic and solar radiation effects on antenna construction are considered. The significant problem involving the effects of hypervelocity impact of minute particles on the antenna is examined thoroughly. The effect of the moon's libration on antenna selection, directivity, and performance is considered. The lower gravity of the moon can simplify construction, assembly, and operations. The absence of cloud layers with their attendant absorption and backscatter helps also. Optimum frequencies for cislunar communications are examined. Author

N64-16203 European Atomic Energy Community, Brussels (Belgium)
SENSITIVITY AND SWITCHING DELAY IN TRIGGER CIRCUITS [SENSIBILITA E RITARDO NEI CIRCUITI A SCATTO]
I. De Lotto (CNR-CISE, Milan) and L. Stanchi (Euratom) Joint Nuclear Research Center, Ispra Establishment (Italy), Electronics Service, Dec. 1963 46 p refs
(EUR-403.1) Available from Belgian American Bank and Trust Co., N.Y., Account No. 121.86: 60 Belg. Fr.

The problem of regeneration in trigger circuits is studied particularly in respect to switching delay and switching time. The factors that affect the speed, such as the threshold as a function of the input signal duration, are examined; the sensitivity of the circuit is also discussed. The characteristics of the dipole equivalent to a trigger circuit are determined, and the switching delay and switching rise time are examined by means of considerable simplifications (circuits with constant parameters) and graphical methods. For the particular case of a transistor circuit the equation of the equivalent circuit is derived taking into account the nonlinearity of the parameters; this equation is processed by means of an analog computer. Author

N64-16244* Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.
THE ELECTRONIC COMPENSATOR
E. L. Michaels and G. F. Paskusz *In its* Methods for the Dyn. Calibration of Pressure Transducers, 12 Dec. 1963 p 97–104 refs (See N64-16236 08-15) GPO: $0.60

An electronic device designed to provide a transfer function, which is the inverse of the transfer function of a given transducer, is described. With the aid of this device the usable frequency range of a transducer system is extended, and the labor involved in the determination of the driving function is reduced. The discussion includes the principles upon which the device is based, a description of the circuit, and the frequency response of the device. C.L.W.

N64-16435 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
THE DESIGN OF BROAD-BAND TUNNEL DIODE AMPLIFIERS
Jack Lepoff 21 Oct. 1963 28 p refs
(Contract DA-36-039-AMC-00088(E))
(EDL-M583; AD-430257)

An analytic method for designing broadband tunnel diode amplifiers is presented. A stabilizing circuit is added to a basic double-tuned circuit in order to prevent out-of-band oscillations. Amplifiers were designed for 1-Gc and 2-Gc bandwidths at C band. Models were built with greater than 10-db gain and less than 5-db noise figure over a 1-Gc band. Author

N64-16468 Naval Ordnance Test Station, China Lake, Calif.
RF FILTERS AS RADIATION-HAZARD SUPPRESSORS
Russell N. Skeeters Feb. 1963 17 p refs
(NAVWEPS-7805, Rev. 1; NOTS-TP-3097; AD-400272)

Ordnance firing circuits can be protected from the probability of inadvertent firing from RF energy by placing a low-pass filter in front of the electroexplosive device. Six typical reactive filters were analyzed, and complex algebra was used to solve for their insertion loss. A nonresonant LC circuit employing dissipation was also investigated. The various filter types studied were compared by examining their insertion loss ratios. E.W.

N64-16512 General Electric Co., Irmo, S.C. Capacitor Dept.
SOLID ELECTROLYTE TANTALUM FOIL CAPACITOR Quarterly Research and Development Report, 1 Oct. 1963-27 Dec. 1963
A. L. Jenny [1963] 34 p ref
(Contract NObsr-89380)
(AD-428360)

Experiments were made on high-temperature treatment of foils at reduced pressure. Foils were treated at 2,100° C for up to 1 hour and were compared with acid-cleaned foils. In the heat-treated foils, there were no flaws or rolling marks visible after formation. These foils were successfully fabricated into 100- and 150-vd.c. prototype devices that have satisfactory characteristics at 85° C. Foil samples were cut, cleaned with detergent, and etched to determine the effect of acid cleaning. Several formations were done on plain and heat-treated foils. Experimental work was continued on the problem of oxide damage during the deposition process. The procedure used in preparing prototype devices for life testing, evaluation purposes, and checking out of contemplated design changes is discussed. Life-test results on the 100-v and 150-v prototype devices are given. E.W.

N64-16587 Aerospace Corp., El Segundo, Calif. Engineering Div.
TRACKING, TELEMETRY, AND COMMAND STUDIES OF GROUND AND SATELLITE SUBSYSTEMS, VOLUME 5, GROUND STATION ANTENNA SURVEY
E. M. Polzin Dec. 1963 85 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-334, Vol. 5; TDR-269(4110-01)-13; AD-431296)

This report lists the basic ground station antenna types used in the field today. The advantages, disadvantages, and characteristics of various antennas are listed for the convenience of system engineers, but no attempt has been made either to describe thoroughly why each antenna exhibits certain characteristics or to single out any type as being the best, since this is a function of specific system requirements and tradeoffs. The report lists many references from some of the common technical journals. The study discusses reflector-, lens-, and array-type antennas, and includes a short discussion of monopulse vs conical scan techniques. Author

N64-16626 Braddock, Dunn and Mc Donald, Inc., El Paso, Tex.
NANOSECOND PULSE BREAKDOWN INITIATION AND GROWTH Final Report
Daniel F. Mc Donald and S. J. Brient Griffiss AFB, N.Y., Jan 1964 45 p refs
(Contract AF 30(602)-2781)
(BDM-B2-102; RADC-TDR-63-525; AD-430341)

The statistics of gaseous breakdown initiation are analyzed in detail. The probability of immediate breakdown is discussed

in terms of the lifetime of electron bursts and the frequency of burst generation by cosmic rays and natural radioactivity. The probability of breakdown during the application of the pulse is discussed in terms of field-assisted electron generation at the walls or electrodes of the test cell. The feasibility of photometric techniques in the study of discharge temporal and spatial growth is considered. Author

N64-16704* Stanford Research Inst., Menlo Park, Calif.
OPERATING AND MAINTENANCE INSTRUCTIONS FOR STANFORD RESEARCH INSTITUTE GRID MIXER
Albert Macovski, Earle D. Jones, and Hugh F. Frohbach Nov. 1963 64 p
(NASA Contract NAS5-1882; SRI Proj. 3927)
(NASA CR-55900) OTS: $6.60 ph, $2.12 mf

The grid mixer accepts a video signal representing a cloud picture, upon command inserts grid points, and then delivers the signal otherwise unchanged. This function is performed for three channels of the Nimbus automatic vidicon camera system (AVCS) information and one channel of high-resolution infrared (HRIR) information. The equipment is contained in one standard rack along with sufficient test equipment to perform maintenance and alignment. The spare AVCS and HRIR gridding unit can be switched to an operating channel by changing the position of a plug on the front of the demodulator and patch panel. If a gridding unit fails, the spare unit can be immediately switched to that operating channel, and maintenance can be performed on the failed unit without system downtime. The units are self-contained; they have separate power supplies and provisions for video and grid inputs and outputs so that bench maintenance can be performed. Author

N64-16820 Lincoln Lab., Mass. Inst. of Tech., Lexington
RESPONSE FUNCTIONS OF LINEAR TIME-VARYING SYSTEMS
J. C. Lindenlaub 9 Sep. 1963 48 p refs
(Contract AF 19(628)-500; ARPA Order 498)
(Rept. 41F-6; AD-422263)

This report treats time-varying networks from the systems viewpoint, in which the emphasis is primarily on the relationships between the input and output signals. A set of time-varying response functions is introduced that has certain advantages in terms of physical interpretation, cascading operations, and specialization to the bandpass case. A number of examples are treated to aid in the physical interpretation of the response functions. A section is presented on linear transformation of the response functions to facilitate the establishment of relationships of these response functions to those introduced by previous authors. Formulas for determining the response functions of time-varying systems in cascade, in terms of the response functions of the individual system, are derived and discussed. Also, the case of narrow-band signals is treated. Separable forms of the response functions are treated, and circuit models are developed for a number of cases. The results obtained from these last two efforts have application in network synthesis and in optimum signal processing. I.v.L.

N64-16821 Lincoln Lab., Mass. Inst. of Tech., Lexington
DESIGN CURVES FOR A CIRCULAR POLARIZER
W. C. Danforth, Jr., and L. J. Ricardi 19 Aug. 1963 10 p
(Contract AF 19(628)-500)
(Rept. 61G-1; AD-417184)

A common method of producing a circularly polarized wave in a constant cross section waveguide consists of exciting two waves that are linearly polarized and mutually orthogonal. Adjusting the relative phase velocity of the two waves permits the production of a single wave which is circularly polarized. Occasionally it is desired to produce right-hand circular polarization at one frequency and left-hand circular polarization at another. The design parameters are usually the ratio of cutoff wavelengths of the two waves, the length of the polarizing section, and the frequencies of operation. The theory of operation and a set of design curves showing the relationship between the parameters are presented. Author

N64-16852 Microwave Associates, Inc., Burlington, Mass.
INVESTIGATION OF HIGH POWER GASEOUS ELECTRONICS Quarterly Progress Report No. 2, 16 Feb.-15 May 1963
H. S. Maddix, J. Gregory, and C. S. Ward 24 Jun. 1960 50 p refs
(Contract DA-36-039-AMC-00097 (E))
(SCL-5794; AD-432139) OTS: $4.60

Cleanup and thermal recovery of inert gases at the interface between a high-power microwave discharge and a quartz surface have been further investigated. Argon, krypton, and helium appear to have comparable cleanup characteristics. Neon reveals the fastest cleanup rate, and xenon does not appear to cleanup in the long term. In all cases the number of atoms sorbed while the discharge was on was observed to be proportional to the square root of time. Rapid and complete recovery of the trapped gas is observed following cleanup at low ambient temperatures. Recovery following cleanup at high ambient temperatures is characterized by a much slower desorption that is linear with the square root of time. Analysis of the data indicates that cleanup and recovery are controlled by activated diffusion. Author

N64-16855 Cornell Aeronautical Lab., Inc., N.Y.
HIGH-TEMPERATURE ANTENNA INVESTIGATION AND DEVELOPMENT Interim Engineering Report No. 2, Quarter Ending 30 Sep. 1962
Godfrey F. Buranich [1963] 38 p refs
(Contract AF 33(657)-11100)
(CAL-UB-1807-E2; AD-422602)

This report summarizes a program to investigate antenna designs suitable for use at temperatures up to 2,000° F. Open-waveguide (slot) antennas are described, and it is proposed to fabricate two such designs. One type will be made of niobium with a beryllium window. The other type will be made of fused quartz and will be platinum plated. A scimitar antenna mounted on a rigid, stainless-steel coaxial feed was made. It was heated to 1,575° F to help evaluate the probable heat conduction along the inner conductor. Tests with the heater used to provide a 2,000° F environment permitted a measurement to be made of the heat conduction along the stainless-steel waveguide used as an antenna feed. Investigations into the plating of high-temperature conductors on fused silica are reported. The experimental work conducted, and the reports of other organizations, indicate that the proposed antenna designs are feasible. Author

10 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations. ***For related information see:*** **06 Auxiliary Systems.**

N64-16114 Aerospace Industries Assn. of America, Inc., Washington, D.C.
JOINT INDUSTRY-GOVERNMENT FORUM AND WORKSHOPS. THE AEROSPACE RELATIONSHIP, SEPTEMBER 16-17, 1963, WASHINGTON, D.C.
[1963] 54 p refs

Participants and records of proceedings for 12 workshops on mutual industry–government problems are given. Subjects covered are electronics, export, facilities, financial management, flight test, industrial security, product support and logistics, propulsion, spare parts, technical manuals, quality control/reliability, and traffic management. R.L.K.

N64-16169 Sperry Gyroscope Co., Great Neck, N.Y. Radiation Div.
SHIP-BASED COMMUNICATIONS AND TRACKING ANTENNAS
Richard C. Price, Francis P. Blatter, Ronald J. Desmond, and Richard W. Larkin *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 6 p (See N64-16151 08-08)
(Contract AF 08(606)-4685)

A number of present and future programs require the advantages to be gained by ship-based antenna systems. The additional design problems of large ship-based antenna systems not present with land-based installations are principally the result of ship vibration, roll, pitch, and flexure. These problems and others are discussed, and the ARIS (Advanced Range Instrumentation Ship) antenna system is used to illustrate a state-of-the-art solution. Author

N64-16175 Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
SPECIFICATION FOR A LUNAR SURFACE VEHICLE, DESIGNED TO SUPPORT AN EARLY APOLLO MISSION
Alan Baker *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 17 p refs (See N64-16151 08-08)

The paper considers three major subsystem areas in detail—communications, power sources, and environmental control. In each area, several possible solutions to the problems of both manned or unmanned operation are presented, and a specific choice made wherever applicable. In communications, the problem of keeping the vehicle in continuous contact with its command station, which may be either on the earth (the unmanned case) or on the moon (the manned case), is considered. The power requirements for the rover will depend primarily upon its weight, its rate of travel, and the mission objectives. The energy requirements for travel and manipulation activities of a three-wheel vehicle are discussed quantitatively. The lunar environment, including the range of operating temperature and expected radiation levels, is discussed. Recommendations for thermal control and protection from solar flares are made. Author

N64-16242* Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.
SHOCK TUBE METHODS
J. L. Schweppe *In its* Methods for the Dyn. Calibration of Pressure Transducers, 12 Dec. 1963 p 77–86 refs (See N64-16236 08-15) GPO: $0.60

A description is given of shock-tube components, followed by qualitative descriptions of shock-tube phenomena, and a general approach to shock-tube theory. The designing of shock tubes for satisfactory pressure-gage calibration is discussed. C.L.W

N64-16254 Federal Aviation Agency, Atlantic City, N.J. National Aviation Facilities Experimental Center
EVALUATION OF A GROUND-BOUNCE RANGING/ALTITUDE EXCHANGING COLLISION AVOIDANCE SYSTEM TECHNIQUE Final Report
Bernhart V. Dinerman and Karl Burkard Oct. 1963 361 p refs (RD-64-5)

A range/range-rate collision prediction technique, implemented in a breadboard collision avoidance system (CAS), was investigated at the National Aviation Facilities Experimental Center (NAFEC). The CAS was installed in two JC-131 aircraft; the effects of terrain and relative velocity on system performance were evaluated during parallel, ascending, descending, divergent, and near-collision flights over water, flat land, mountains, and cities. The airborne test results confirm the validity of a collision avoidance technique based upon the range/range-rate (tau) relationship. However, when range data are derived by the ground reflection technique, inaccuracies due to irregular terrain contour result in false alarms and missed alarms. The principal recommendation is that the tau technique be seriously considered for further application in any new development of a collision avoidance system. Author

N64-16289 RAND Corp., Santa Monica, Calif.
PRELIMINARY DESIGN OF MARS BASING
Percy H. Bliss May 1963 22 p refs Presented at Symp. on Exploration of Mars, Denver, 6–7 Jun. 1963
(P-2747)

This paper is an attempt to focus attention on the design and construction problems for a Martian base. An immediate, prefabricated, inflatable shelter is proposed for the first crew that lands on Mars; the shelter will serve for headquarters while additional base construction is performed. The use of indigenous materials for structures is proposed where possible to reduce transporation and construction costs. Prefabricated structures are advocated from imported materials, using steel, aluminum, wood, wood products, plastics, rubber fabrics, or polyurethane plastics. Block construction could be used with either imported cements or with blocks and cements manufactured from Martian materials. The design and construction of basing facilities on Mars appear to be within the limits of present technologies, but it is emphasized that designs proposed herein will probably require considerable modification as more information about the environment and available materials on Mars is obtained. Author

N64-16291 Advisory Group for Aeronautical Research and Development, Paris (France)
A FLIGHT TEST METHOD FOR THE EVALUATION OF APPROACH AND RUNWAY LIGHTING EFFECTIVENESS
T. van Oosterom Jan. 1963 25 p refs Presented at the Aircraft Take-Off and Landing Specialists Meeting sponsored by the AGARD Flight Mech. Panel, Paris, 15–18 Jan. 1963
(AGARD-431)

A flight operational method for evaluating the effectiveness of visual approach and landing aids is described. The method is based on a quantitative appraisal of the guidance obtained from a given configuration of lights by measuring the quality of the approach and landing and by determining the pilot's effort in carrying out these maneuvers. To this end, relevant flight technical and physiological measurements are made, and the test results are expressed in quality marks by a specially developed interpretation procedure. For simulating consistent and marginal weather conditions, a cockpit fog simulator has been developed consisting of a gyro- and altitude-controlled movable opaque screen mounted in front of the subject pilot. The safety pilot is not subjected to any restriction of visibility.

The tests are performed on a statistical basis so that the real significance of the differences in effectiveness between light configurations as found from the trials can be determined.
Author

N64-16316* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROBLEMS IN THE CONSTRUCTION OF A SPACE ENVIRONMENT SIMULATOR
Dana S. Cope Washington, NASA, Mar. 1964 16 p
(NASA TN D-1917) OTS: $0.50

Problems concerning the material and construction of reflectors are presented in some detail. At present this facility provides oil-diffusion, cryogenic pumping, and controlled wall temperatures. Solar hardware fabrication is in the process of completion.
Author

N64-16364 Air Force Systems Command, Wright-Patterson AFB, Ohio
A METHOD OF CALCULATING RETARDATION TEMPERATURE IN A HYPERSONIC WIND TUNNEL WITH MOVABLE PISTON AND REMARKS ON THE PLANNING OF SUCH WIND TUNNEL
Wiktor Jungowski 20 Jun. 1963 20 p refs Transl. into ENGLISH from Aroh. Budowy Maszyn (Warsaw), v. 9, no. 3 1962 p 399–441
(FTD-TT-63-312-1+2; AD-412891)

A description is given of a method for calculating retardation temperature in a hypersonic wind tunnel with a movable piston. The method was developed as a result of analyzing phenomena appearing in a wind tunnel and of making several variants of calculations with consideration of various factors influencing retardation temperature. The application of the method for planning of tunnels with movable pistons is discussed, and conclusions were made with respect to efficiency of such tunnels.
Author

N64-16647 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
FIXED-BASE SIMULATOR INVESTIGATION OF THE EFFECTS OF L_α AND TRUE SPEED ON PILOT OPINION OF LONGITUDINAL FLYING QUALITIES
Charles R. Chalk Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Nov. 1963 175 p refs
(Contract AF 33(657)-7442)
(ASD-TDR-63-399; AD-430012)

The effects of L_α and true speed on longitudinal flying qualities, optimum control gain, and normal acceleration response to turbulence were investigated in a ground simulator. The steady-state ratio of normal acceleration to angle-of-attack was found to be of significance both to the flying qualities of an airplane and to the optimum longitudinal control gain. Normal acceleration response to rough air was demonstrated to be primarily a function of L_α and the short period frequency and damping ratio.
Author

N64-16706* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPECIALIZED COST STUDY, LAUNCH COMPLEX 39-PNEUMATIC SYSTEM
M. B. Loeb 15 Jul. 1963 23 p
(NASA TM X-54645; TR-4-13-2-D) OTS: $2.60 ph, $0.89 mf

The report covers cost responsibilities of the LO-DP23 office concerning pneumatic systems for conversion, transmission, and storage of gases at various pressures from 6,000 to 10,000 psig. The report shows that the optimum conditions of design occur at 12,000, 10,000, and 7,400 psig, depending on the selection of materials used for the cross-country pipe. These optimum pressures are for systems with cross-country pipe materials of AISI 4320 steel with stainless liner, A106 Gr. C steel pipe with stainless liner, and type 316 stainless steel, respectively. These were the only pipe materials considered.
Author

N64-16746* Advanced Kinetics, Inc., Costa Mesa, Calif.
LABORATORY SIMULATION STUDIES OF OUTER SPACE PHENOMENA Third Quarterly Status Report, Oct. 16, 1963-Jan. 15, 1964
A. N. Dienes 30 Jan. 1964 25 p refs
(NASA Contract NASw-702)
(NASA CR-53107) OTS: $2.60 ph, $0.95 mf

The current program status includes the following: (1) The major achievement was the completion of installation of a new and larger vacuum chamber. The enlarged chamber is now a total of 135 cm long. The glass cylinder used for viewing the plasma electromagnetic-field interaction is 105 cm long and 30 cm in diameter. To accompany this expansion of the vacuum chamber, several modifications in the auxiliary apparatus were made. The dipole was reconstructed in order to locate the dipole field some 40 cm from the end of the glass portion of the vacuum chamber. A liquid-nitrogen trap was placed inside the vacuum for the purpose of cryogenic pumping. The mirror above the glass vacuum chamber has been relocated to enable simultaneous image-converter photography of both the equatorial and polar view of the interaction. In addition, the three-dimensional analysis of the observed geomagnetic cavity has been facilitated. (2) A three-dimensional magnetic probe, i.e., a probe capable of measuring the three components of the magnetic field, was designed and constructed. (3) The accurate shape of the cavity in the equatorial plane, on the dayside, has been determined. Also, a megampere, high-vacuum, low-inductance current feedthrough is discussed.
I.v.L.

N64-16756* Michigan U., Ann Arbor Lab. for Fluid Flow and Heat Transport Phenomena
CAVITATION DAMAGE AND PERFORMANCE RESEARCH FACILITIES Technical Report No. 12
Frederick G. Hammitt 1 Oct. 1963 38 p refs
(NASA Contract NASw-6550; NASA Grant NsG-39-60; NSF Grant G-22529; ORA Proj. 03424)
(NASA CR-53119; Rept. 03424-12-T) OTS: $3.60 ph, $1.34 mf

Cavitation research facilities are described. These include tunnel and ultrasonic, vibratory facilities, especially adapted for a wide variety of fluids and operating conditions. Various specialized techniques that have been developed and utilized are also described.
Author

N64-16827 Sylvania Electric Products, Inc., Needham, Mass.
THE UDOFT FLIGHT SIMULATION SYSTEM Summary Report, Jan. 1956-Dec. 1960
Julian Wargo et al Wright-Patterson AFB, Ohio, Behavioral Sci. Lab., Dec. 1963 290 p refs
(Contract AF 33(657)-7605; Contract N61339-40; Contract N61339-1150; Contract N61339-853)
(AMRL-TDR-63-133; AD-431205) OTS: $4.00

UDOFT (Universal Digital Operational Flight Trainer) represents the first full-scale application of a high-speed, general-purpose digital computer to the real-time flight simulation

problem. Through the use of the stored-program digital computer, simulation of different aircraft is accomplished by changing the computer program. With the use of dual, 4,096-word, random-access, magnetic core memories, the basic instruction time for the UDOFT computer is five microseconds. To interface with the analog environment of a flight compartment, the UDOFT computer is equipped with a special-purpose, real-time input–output capability. Use of the computer in a simulation system demanded the preparation of programs for applying the computer to the solution of the mathematical model of the real-world system under consideration. Such programs were written for the F-100A and the F9F-2. Extensive qualification testing was performed to ensure proper and complete simulation of these aircraft. Author

N64-16887 Dunlap and Associates, Inc., Stamford, Conn.
HUMAN FACTORS TECHNOLOGY IN THE DESIGN OF SIMULATORS FOR OPERATOR TRAINING
Alfred F. Smode, Alin Gruber, and Jerome H. Ely 18 Dec. 1963 196 p refs
(Contract N61339-1103)
(NAVTRADEVCEN-1103-1; AD-432028)

This report summarizes basic human factors information that influences the design and construction of training devices. Successive chapters of the report are devoted to determining training needs, developing the environment for learning, understanding simulation requirements for training, developing a measurement capability, and discussing the human engineering problems in trainer design. Author

11 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. *For related information see:* 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; 13 Heat Transfer and Thermodynamics; and 24 Physics, Plasma.

N64-16129 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
DOUBLE SHOCK TUBE METHOD FOR SIMULTANEOUS DETERMINATION OF HIGH PRESSURE AND TEMPERATURE OF AN ENCLOSED GAS
W. R. Grabowsky, L. Y. Lam, and D. A. Durran 20 Jan. 1964 19 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-368; TDR-269(4230-10)-6; AD-430295)

A method for the simultaneous determination of pressure and temperature of a confined, impulsively heated gas is discussed. The method requires the measurement of the shock Mach numbers in two small shock tubes that use the impulsively heated gas as a driver. Different initial pressures in the shock tubes result in two simultaneous equations for driver pressure and temperature as a function of the measured shock Mach numbers. These equations are examined for ideal and real gases in the limit of infinite driver-to-driven section area ratio. The effect of contamination of the driver gas during the heating pulse is also considered. Author

N64-16313 Advisory Group for Aeronautical Research and Development, Paris (France)
PROPERTIES OF THE FLUCTUATING WALL-PRESSURE FIELD OF A TURBULENT BOUNDARY LAYER
M. K. Bull (Southampton U.) Apr. 1963 42 p refs In ENGLISH; FRENCH Summary
(AGARD-455)

The results of measurements of various statistical properties of the fluctuating wall-pressure field associated with turbulent subsonic boundary-layer flow in conditions covering a range of values of boundary-layer thickness and flow speed are given. The measured quantities include overall rms pressures, frequency spectra, and longitudinal and lateral space–time correlations in both broad and narrow frequency bands. Some experimental values of space–time correlation between wall-pressure fluctuations and turbulent velocity fluctuations at various positions in the boundary layer are also presented. These experimental results and some of their implications on the structure of the wall-pressure field and the nature of its convection and decay are discussed. Author

N64-16318 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
PITOT-STATIC PROBES FOR SUBSONIC AND SUPERSONIC AIRCRAFT [SONDES ANEMO-BAROMETRIQUES POUR AVIONS SUBSONIQUES ET SUPERSONIQUES]
J. Chaffois London, Min. of Aviation, Nov. 1963 31 p refs Transl. into ENGLISH from Tech. Sci. Aeron. Spatiales (Paris), no. 1, 1962 p 7–17
(RAE-TRANS-1032)

The problem of measuring reference pressures (stagnation pressure and undisturbed static pressure) is fairly simply solved for subsonic aircraft. For a supersonic aircraft, the choice is extremely difficult, particularly for the static measurement, due to the widely different characteristics of the pressure field at subsonic and supersonic conditions. This report presents a family of solutions to this problem and describes the form in which it has been applied to the G.A.M.D. Mirage III, an aircraft in the Mach 2 class. Author

N64-16371 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MEASURING THE INSTANTANEOUS RATES OF FLOW OF A LIQUID BY AN ELECTRO-THERMO-ANEMOMETER AND THE METHOD OF ELECTROMAGNETIC INDUCTION
M. G. Selyaninov 20 Jun. 1963 13 p refs Transl. into ENGLISH from a Russian book "Novyye Metody Izmereniy i Pribory Dlya Gidravlicheskikh Issledovaniy" Moscow, Izd. Akad. Nauk SSSR, 1961 p 49–55
(FTD-TT-63-482/1+2; AD-412883)

A heated-film thermoanemometer is discussed in conjunction with a linearized amplifier and root-mean-square analyzer. This thermoanemometer, with automatic stabilization of the temperature of the pickup, is especially suitable for measurements in systems on a large scale, with pulsations of great amplitude, where the value of the time constant of the pickup changes even in the course of one period. A probe for measuring the voltage induced in a liquid is discussed. The voltage of the probe is passed to the input of a push–pull d.c. amplifier with great input resistance and a low level of noise. On the output of the amplifier are coupled a thermoelectric voltmeter for reading the root-mean-square value of the pulsations and loop and electronic oscillographs for recording the pulsations and calibration according to the average velocity. This system of flow measurement by electromagnetic induction is applicable to systems with small geometrical dimensions and with variable parameters of the liquid. I.v.L.

N64-16378 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HIGH-VELOCITY CUMULATIVE JETS
N. P. Novikov 15 Aug. 1963 17 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (USSR) no. 6, 1962 p 22–28
(FTD-TT-63-566/1+2+4; AD-417414)

The obtaining of high-velocity cumulative jets is described, the structure of the jets is studied from slow-motion pictures, and the state of the material in them is studied from the luminosity spectra of the process. A number of dependences of the velocity of the high-velocity jet on various parameters are given, and, finally, an attempt is made to consider the high-velocity and main cumulative jets as the discharge of a highly compressed metal into a vacuum. Author

N64-16395 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE TURBULENT BOUNDARY LAYER OF A GAS ON A PERMEABLE WALL
S. S. Kutateladze and A. I. Leontev 23 Oct. 1962 20 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow) no. 1, 1962 p 51–60
(FTD-TT-62-1315/1+2+4; AD-292189)

Based on the theory of limiting laws of a turbulent boundary layer, a method is set forth that permits calculation of heat transfer and friction on a porous plate and on the surface of the frontal part of a body in the region of a turbulent boundary layer. Consideration is given to the turbulent boundary layer of a gas on a flat permeable surface. C.L.W.

N64-16402 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STABILITY AND TURBULENCE OF LIQUID FLOWS
Werner Heisenberg 9 Aug. 1963 58 p refs Transl. into ENGLISH from Ann. Phys. (Leipzig), v. 74, no. 15, 1924, p 577–627
(FTD-TT-62-1596/1+2+3+4; AD-415016)

This study is divided into two parts, one dealing with stability problems and the other with turbulent motion. In the first part, an attempt is made to generalize, as far as possible, the conditions to which unstable and stable profiles are subject, to show methods for solving the equation of stability for any velocity profile, and to calculate that critical Reynolds number that results for unstable profiles. To show the applicability of the methods, a full calculation of the parabolic profile is given. In the second part, an attempt is made to derive differential equations for the turbulent motions under highly idealized conditions, in order to get information on properties of the turbulent velocity distribution. R.T.K.

N64-16403 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BEHAVIOR OF SMALL OSCILLATIONS ON VISCOUS FLUID FLOW
Ludwig Hopf 21 Jun. 1963 57 p refs Transl. into ENGLISH from Ann. Physik (Leipzig), v. 44, no. 9, 1914 p 1–60
(FTD-TT-62-1597/1+2+3+4; AD-413096)

Complete calculation of the behavior of small oscillations that are superposed on laminar flow in a viscous fluid was reduced to a transcendental equation. This equation is solved for attenuation, velocity of propagation of disturbances, and for a complete description of streamlining. The course of small oscillations on a flow of viscous fluid is described by means of the roots of the equations. C.L.W

N64-16436 Minnesota U., Minneapolis
MASS AND HEAT TRANSFER RATES FOR LARGE GRADIENTS OF CONCENTRATION AND TEMPERATURE Summary and Final Report
William E. Ranz and Philip F. Dickson 16 Sep. 1963 53 p refs
(Contract DA-11-022-ORD-3084)
(AD-430278)

The problem of large-gradient transfer was reviewed and redefined; experimental data were obtained in well-controlled systems; and a return was made to an earlier method of analysis (the von Karman–Pohlhausen integral method for boundary-layer solution), which gains in physical generality what it loses in mathematical rigor. Stagnation regions and a completely turbulent boundary layer on a flat plate were chosen as general flow configurations worthy of careful study. Attention was focused on physical aspects of the transfer problem, such as simultaneous transfer, variations in transport coefficients, large gradients in concentration and temperature, large concentrations of the diffusing component, convection caused by diffusion, and primacy of boundary conditions. In addition to empirical correlations (which can be based on a dimensional analysis of the equations of change) and to the simple concept of a "stagnant film," Prandtl's boundary-layer theory has been extended to obtain so-called "exact" and "nearly exact" solutions for heat- and mass-transfer rates in boundary layers.
I.v.L.

N64-16448 Toronto U. (Canada) Inst. of Aerophysics
NONEQUILIBRIUM EXPANSION FLOW OF IONIZED ARGON AROUND A CORNER
I. I. Glass and A. Takano Sep. 1963 100 p refs
(Sponsored by AFOSR, Can. Natl. Res. Council, and Defence Res. Board)
(UTIAS 95; AFOSR-5446; AD-429222)

A detailed study is presented of nonequilibrium, inviscid expansion flows of ionized argon around a corner. The calculating procedure is based on the method of characteristics and is similar to that for dissociating oxygen. The numerical computations were performed on an IBM-7090 computer for a number of cases with different free-stream conditions and wall angles. It was assumed that, in the temperature range considered, the internal electronic excitation was always at its ground state and that atoms, ions, and electrons had the same translational temperature. The overall flow pattern obtained was found to be qualitatively similar to that of dissociating oxygen. However, an important exception was the nonexistence of a deexcitation shock wave, which was verified up to large wall angles and when using a small size of characteristic mesh. Quasi-similarities of the variations of the flow quantities along the wave head and along the wall surface were found to exist, when their appropriately normalized values were plotted as functions of relevant distances. Author

N64-16472 RAND Corp., Santa Monica, Calif.
A SIMPLIFIED ANALYSIS OF SKIN FRICTION AND HEAT TRANSFER IN BINARY BOUNDARY-LAYER FLOW
Ting Y. Li Sep. 1963 75 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-2872-PR; AD-418037)

A simplified analysis of binary boundary-layer flow on a flat plate is presented. Analytical formulas of skin friction, surface mass transfer, and heat transfer are derived. The effects on skin friction of various parameters, such as Prandtl number, Lewis number, molecular weight ratio, and heat transfer in binary boundary layers are exhibited explicitly in these analytical formulas. The results agree well with the more exact numerical

calculations. In addition, some intricate coupling of viscosity, heat conduction, and diffusion is exhibited. The conditions are also given under which the set of approximate formulas describing boundary-layer flow on a flat plate were obtained.
C.L.W.

N64-16481 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MONODIMENSIONAL ADIABATIC FLOW OF A TWO-PHASE MEDIUM
Jozef Smigielski 23 Jul. 1963 20 p refs Transl. into ENGLISH from Prace Inst. Maszyn Przeplywowych, Polska Akad. Nauk (Warsaw), no. 10, 1962 p 3–20
(FTD-TT-63-378/1+2; AD-415077)

The adiabatic expansion two-phase factor in a straight nozzle is discussed. A solution was obtained for the case of accelerated flow, which takes place, for example, in turbine nozzles. A general solution was also obtained for a channel in which a linear increase in velocity takes place. R.T.K.

N64-16497 Army Missile Command, Huntsville, Ala.
ON THE MOTION OF A LIQUID IN AN OSCILLATING CONTAINER
V. V. Bolotin 14 Feb. 1964 9 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), 20, 1956 p 293–294
(RSIC-133; AD-430954)

The oscillation of a liquid in a container, according to a given equation, increases exponentially within the regions of instability. However, experience indicates an oscillation of finite amplitude. In order to determine the oscillation, it is necessary to examine the problem in terms of a nonlinear formula by retaining quadratic terms in the equation of motion. The linear equations considered in this report are essentially variation equations set up for the case where, for the unperturbed motion (more accurately, equilibrium), a horizontal surface of the liquid is assumed. Strictly speaking, the linear theory leaves open the question concerning the equilibrium stability of the liquid outside the regions of excitation. To overcome this difficulty, it is necessary to examine the problem with consideration for viscosity. I.v.L.

N64-16506 Douglas Aircraft Co., Inc., Long Beach, Calif. Aircraft Div.
SOLUTION OF THE GENERAL BOUNDARY-LAYER EQUATIONS FOR COMPRESSIBLE LAMINAR FLOW, INCLUDING EQUILIBRIUM DISSOCIATION
Darwin W. Clutter and A. M. O. Smith [1963] 38 p refs Presented at the 6th DOWACA Symp. on Aeroballistics, Washington, D.C., 31 Oct.–1 Nov. 1963
(Contract NOw-60-0533-C)
(Douglas Paper 1657; AD-428079)

An accurate and rapid method is presented for solution of the complete equations of compressible, steady, laminar-boundary-layer flow. The method allows arbitrary conditions for all of the following: pressure gradient, surface temperature and its gradient, heat transfer, mass transfer, and fluid properties. It can handle flows in which equilibrium dissociation occurs. Also, the second-order effect of transverse curvature is retained. The only restrictions are geometric—the flow must be either axially symmetric or two-dimensional. The method of solution consists of replacing the partial derivatives with respect to the flow direction by finite differences, while retaining the derivatives in a direction normal to the boundary, so that the partial differential equations become approximated by ordinary differential equations. Arbitrary fluid properties may be used in the method of solution; that is, they are inputs in the computer program in the form of formulas or tables as functions of local enthalpy and pressure. Author

N64-16510 Emmanuel Coll., Boston, Mass. Research Language Center
INVESTIGATING THE KINETIC ENERGY OF TURBULENT CURRENTS USING WEIGHTED AVERAGES [UBER DIE ERMITTLUNG DER KINETISCHEN ENERGIE TURBULENTER STROMUNGEN BEI VERWENDUNG GEWICHTETER MITTELWERTE]
F. Wippermann Bedford, Mass, AFCRL [1961] 15 p refs Transl. into ENGLISH from Beitr. Physik Atmos. (Frankfurt am Main), v. 33, no. 3–4, 1961 p 225–231
(Contract AF 19(604)-8505)
(E-T-G-63-28; AD-430583)

In general the phrase "kinetic energy of a turbulent current" refers to the arithmetic mean of the squares of the velocity fluctuations. These are defined as the deviations of the observed velocities from their arithmetic mean, called the basic current. But if for any reasons (e.g., because of the instrumentation used) the velocity fluctuations are deviations from a weighted mean, a different value is obtained for the kinetic energy. It is possible to derive a conversion factor that gives the correct value. At the same time, information is obtained about the spectral distribution of the error that arises when weighted means are used. Author

N64-16531 Aeronautical Research Council (Gt. Brit.)
A SIMPLIFIED TREATMENT OF LOSSES FOR ONE-DIMENSIONAL MIXING BETWEEN HOT AND COLD GAS STREAMS AT CONSTANT PRESSURE AND LOW VELOCITY
B. S. Stratford and J. G. Williams London, HMSO, 1963 24 p refs
(ARC-CP-686; previously issued as NGTE-NT-496; ARC-23899)
HMSO: 5s

Standard theory for the one-dimensional mixing between hot and cold gas streams is straightforward in principle, but the results can be rather difficult to interpret and quite lengthy to calculate. The interpretation can be difficult either in obtaining a physical understanding, or for seeing general trends. Several simplified formulas may be put forward to supplement the existing methods of analysis. Most of the formulas in the present paper are concerned with the loss of total pressure during mixing; these formulas are limited to flow at low Mach number. A further analysis concerns the gain of thrust that results when two streams of air supplying a propelling nozzle in compressible flow are mixed before the nozzle. Author

N64-16532 Aeronautical Research Council (Gt. Brit.)
THE MIXING WITH AMBIENT AIR OF A COLD AIRSTREAM IN A CENTRIFUGAL FIELD
B. S. Stratford, Z. M. Jawor, and G. T. Golesworthy London, HMSO, 1963 36 p refs
(ARC-CP-687; previously issued as NGTE-M-355; ARC-23947)
HMSO: 7s

Tests have been made to compare the rate of mixing with ambient air of a single-sided cold air jet when flowing over straight and curved surfaces. The rate of mixing, defined as the rate of entrainment of ambient air into the stream, was determined in two ways: from direct measurement of the increase of mass flow inside the jet and from the entrainment velocity derived from measurements of the static pressure close to the jet boundary. The experimental results, though

showing considerable scatter, lend confirmation to earlier deductions that a centrifugal field increases the mixing rate. A typical increase in mixing rate is 50%. Author

N64-16657 Polytechnic Inst. of Brooklyn, N.Y.
AN EXPERIMENTAL INVESTIGATION OF THE TURBULENT MIXING ON NON-HOMOGENEOUS COAXIAL JETS
Louis J. Alpinieri Aug. 1963 73 p refs
(Contract AF 49(638)-217)
(PIBAL-789; AFOSR-5242; AD-421741)

Experimental results on the turbulent mixing process between carbon dioxide and hydrogen central jets exhausting into a moving concentric stream of air are presented. The diffusion of mass and momentum only are considered, since both streams are at approximately equal temperature. The flow velocities are in the low to high subsonic range. Principal points of investigation are the condition of equal velocity between jets and the condition of equal mass flow per unit area between jets. Radial and axial distributions of concentration and velocity are presented. On the basis of the measurements it is concluded that no tendency toward segregation of the stream exists when either the velocities or the mass flows of the streams are equal. Furthermore, it is demonstrated that the product of local density and eddy kinematic viscosity coefficient can be assumed to be solely dependent upon the axial coordinate. Author

N64-16763* Michigan U., Ann Arbor Lab. for Fluid Flow and Heat Transport Phenomena
CAVITATION DAMAGE MEASUREMENTS IN MERCURY BY RADIOTRACER ANALYSIS Technical Report No. 10
Willy Smith, Juan M. Nieto, and Frederick G. Hammitt Oct. 1963 78 p refs
(NASA Grant NsG-39-60; ORA Proj. 03424)
(NASA CR-53112; Rept. 03424-10-T) OTS: $7.60 ph, $2.54 mf

The development of a method of continuous measurement of the wear of metal specimens submitted to a constant cavitation field by using radiotracer techniques was attempted. Samples of type 302 stainless steel and type 1010 carbon steel were irradiated in a nuclear reactor and then placed in a cavitating venturi in a closed-loop mercury facility. It was discovered that due to the arrangement of the centrifugal pump, the radioactive particles of steel separate at once and tend to be trapped on the liquid surface of the pump sump. By dismantling this sump, about 6% of the measured weight loss of the carbon steel specimens was recovered. This radioactive material was collected and filtered, which allowed a classification by size. Differential curves obtained for the different size debris indicate that the constituents do not vary with particle size.
Author

N64-16764* Michigan U., Ann Arbor Lab. for Fluid Flow and Heat Transport Phenomena
DETERMINATION OF CAVITATION CONDITIONS FROM DENSITY PROFILES OF MERCURY IN A VENTURI Technical Report No. 11
Ian E. B. Launchlan, Frederick G. Hammitt, Richard D. Ivany, M. John Robinson, and Willy Smith Oct. 1963 45 p refs
(NASA Grant NsG-39-60; ORA Proj. 03424)
(NASA CR-53113; Rept. 03424-11-T) OTS: $4.60 ph, $1.55 mf

The extent of the cavitation in mercury flowing in a transparent, Plexiglas venturi can be determined by measuring the decrease in the attenuation of a well-collimated, Co^{60} gamma beam in passing through the venturi when voids resulting from cavitation are present. Experimental results for the axial fluid density profile are consistent with the visual appearance of the cavitating flow. Author

N64-16797 Aerospace Research Labs., Wright-Patterson AFB, Ohio Fluid Dynamics Facilities Lab.
FLOW TABLES FOR AIR (γ=1.4) PASSING AN ABRUPT AREA INCREASE OBLIQUE TO THE FLOW DIRECTION
Arthur J. Wennerstrom Jan. 1964 175 p
(ARL-64-10; AD-431862)

Presented are tabulated values of the flow conditions before and after a step increase in area oblique to the flow direction. This condition may arise with a swirl flow in an annulus, or flow between parallel planes that extend to infinity in the direction parallel to the step. The tables apply to a compressible fluid with a specific-heat ratio of 1.4. The flow is assumed adiabatic and without wall friction. Downstream conditions apply at a location sufficiently far downstream such that uniform flow has been reestablished. Input variables considered are area ratio, Mach number component normal to the abrupt area change, and the angle between the flow direction and the normal. Calculated quantities are the absolute upstream and downstream Mach numbers, the angle between downstream flow and the normal, static pressure ratio and total pressure ratio. The method of calculation is described. Author

N64-16828 Mississippi State U., State College
IMPERVIOUS TURBULENT BOUNDARY LAYER MEASUREMENTS USING AN INTEGRATING BOUNDARY LAYER MOUSE
Gary N. Smith and Paul J. Carpenter Ft. Eustis, Va., Army Transportation Res. Command, Nov. 1963 25 p refs
(Contract DA 44-177-AMC-892(T))
(TRECOM-TR-63-70; Aerophysics Res. Note 17; AD-432128) OTS: $2.60

The composite boundary-layer mouse is an alternative method to the boundary-layer velocity profile technique of determining all the pertinent parameters of a turbulent boundary layer. The accuracy of the system in comparison with the profile method was well within experimental tolerances usual with the measurement of boundary-layer velocity profiles. The use of the composite system simplified the data reduction that could be performed by any computer, reduced the data reduction time, and thereby appreciably speeded up the entire boundary-layer research program. Author

N64-16836 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
MOMENTUM-INTEGRAL SOLUTIONS FOR THE LAMINAR BOUNDARY LAYER ON A FINITE DISK IN A ROTATING FLOW
W. S. King 18 Jun. 1963 51 p refs
(ATN-63-(9227)-3; AD-432129)

The laminar boundary layer produced by the rotating flow of a viscous incompressible fluid over a finite stationary disk is considered. The boundary-layer equations for flows in which the external tangential velocity varies as some power of the radius ($V_e \sim r^n$) and the external radial velocity is zero are solved using several variations of the Kármán–Pohlhausen momentum–integral method. The results of numerical integration of the boundary-layer equations are compared to the momentum-integral solutions of Taylor and Cooke and the series solution of Mack. If the outer flow is a potential vortex ($n = -1$), the methods investigated yield widely varying results for radial

inflow and the axial velocity distribution in the boundary layer; the simplest integral method employed agrees best with the series solution. Author

N64-16839 North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
BOUNDARY LAYER TRANSITION-FREE-STREAM TURBULENCE AND PRESSURE GRADIENT EFFECTS
E. R. van Driest and C. B. Blumer Apr. 1963 20 p refs
(Contract AF 49(638)-1178)
(SID 63-390; AD-432135) OTS: $2.60

A theory of boundary-layer transition is presented that includes the effects of free-stream turbulence and pressure gradient. The basic notion underlying the development concerns the remoteness of the boundary-layer vorticity from the surface. The theory agrees well with experimental data. The laminar boundary-layer solutions of Pohlhausen and Falkner–Skan are used to calculate the effect of pressure gradient on transition. Engineering formulas are presented, and one example is calculated that shows the application of the theory to a body of revolution. The theory can also indicate the effects of Mach number and heat transfer. Author

N64-16865 Avco-Everett Research Lab., Everett, Mass.
ARGON AND NITROGEN SHOCK THICKNESSES
Morton Camac Dec. 1963 18 p refs
(Contract AF 04(694)-414; Contract DA-19-020-AMC-0210; ARPA Order 525; Proj. DEFENDER)
(Avco-Everett Res. Rept. 172; BSD-TDR-63-257; AD-431585)

The density variation during translational and rotational adjustment in shock waves was measured. The major equipment used consisted of a 24-in.-diam. shock tube and an electron gun. Preliminary data from Mach 3 to 9 indicate that the shock density thicknesses based on the maximum slope vary from 4 to 5 and 3 to 4 times the upstream mean free path for argon and nitrogen, respectively. For nitrogen, translation and rotation are coupled; the density increases smoothly to the density where both modes are equilibrated. The experimental shock density thicknesses for argon are in excellent agreement with the bimodal theory and over 1.5 times thicker than the Navier–Stokes predictions. Author

N64-16874 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
CONFINED VORTEX FLOWS WITH BOUNDARY-LAYER INTERACTION
M. L. Rosenzweig, W. S. Lewellen, and D. H. Ross 20 Feb. 1964 29 p refs
(ANT-64(9227)-2; AD-431844)

Axisymmetric flow of an incompressible fluid in a right-cylindrical vortex tube bounded by planar end walls is considered. The mutual interaction of the primary vortex flow field and the end-wall boundary layers is studied by relating the stream function and circulation in these regions. An interaction parameter is defined that determines the magnitude of the influence of the boundary layers on the circulation and mass-flow distributions in the primary flow. These distributions are obtained numerically, primarily as functions of the interaction parameter and the Reynolds number based on the radial flow. Experimental results are interpreted in the light of this theory, and it is concluded that substantial turbulence levels (though somewhat less than estimates made without consideration of boundary layer effects) must be assumed to explain the experimental results. Author

12 GEOPHYSICS

Includes auroral phenomena; upper atmosphere studies; oceanography; cartography; geodesy; and geomagnetism. *For Van Allen belts see*: 28 Space Radiation. *For related information see*: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N64-16117* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYNCHROTRON RADIATION CALCULATIONS FOR THE ARTIFICIAL RADIATION BELT
M. P. Nakada Washington, NASA, Jan. 1964 16 p refs
(NASA TN D-2097) OTS: $0.50

Calculations of synchrotron radiation from the artificial radiation belt are presented that are somewhat more detailed than those made previously. The angular distribution of the electrons and of the synchrotron radiation is considered. Omnidirectional electron fluxes given by other authors are used to derive directional fluxes. Temperatures as a function of frequency and the geomagnetic latitude at 30 Mc are calculated. The results are compared with measurements. Author

N64-16201 Bayerische Akademie der Wissenschaften, Munich (W. Germany) Deutsche Geodatische Kommission
HISTORY AND SIGNIFICANCE OF AN INTERNATIONAL EARTH MEASUREMENT [GESCHICHTE UND BEDEUTUNG DER INTERNATIONALEN ERDMESSUNG]
Ulrich Volter (Ph. D. Thesis–Munich U.) 1963 79p In GERMAN (*Its* C-Dissertations-63)

A general history is given of international earth measurement from 1862 to 1962. In addition, the state-of-the-art of the following areas is discussed, in chronological order, for this period: (1) triangulation; (2) leveling; (3) geodetic astronomy; (4) the determination of geoids with the aid of astronomical–geodetic measurements; and (5) the determination of geoids with the aid of gravity measurements. I.v.L.

N64-16248 RAND Corp., Santa Monica, Calif.
DETERMINATION OF THE D-LAYER DISSOCIATIVE RECOMBINATION COEFFICIENT FROM A HIGH ALTITUDE NUCLEAR EXPLOSION
R. E. LeLevier Aug. 1963 17 p refs
(P-2756)

From measurements of the magnitude and time dependence of X-ray-induced absorption over Midway during the July 9, 1962, high-altitude nuclear explosion, bounds can be inferred on the dissociative recombination coefficient α of the D-layer of the ionosphere. Analysis of the data indicates that α lies between 3×10^{-7} cm^3/sec and 7×10^{-7} cm^3/sec. Author

N64-16249 RAND Corp., Santa Monica, Calif.
TURBULENCE, DIFFUSION, AND GRAVITY WAVES
W. W. Kellogg Aug. 1963 5 p refs Submitted for Publication
(P-2774)

A review is presented of some of the ideas that occurred and observations that have been made in the past few years relating to the transition region between the stratosphere and the ionosphere. Techniques that have been used to study the mesosphere (about 60 to 80 km) and the lower thermosphere

(80 to 110 or to 120 km) are discussed. Information is also presented on the extreme and variable winds, the anomalous changes of temperature that occur with changes in latitude and season, and on the internal gravity waves of the region. R.T.K.

N64-16284* RAND Corp., Santa Monica, Calif.
INTEGRAL AND SPHERICAL-HARMONIC ANALYSES OF THE GEOMAGNETIC FIELD FOR 1955.0, PART I
E. H. Vestine, W. L. Sibley, J. W. Kern, and J. L. Carlstedt Repr. from J. Geomagnetism and Geoelectricity, v. 15, no. 2, 1963 p 47–72 refs
(NASA Contract NASr-21(05))

The geomagnetic field is analyzed by spherical harmonics. Series representations in spherical harmonics of geomagnetic field charts are compared for truncation of the series at terms of degree 6, 8, 10, and 12. Scalings are at a uniformly spaced latitude-longitude grid from both U.S. and U.S.S.R. isomagnetic charts for 1955.0. Some minor but undesirable effects are mentioned that arise because of the uniform angular spacing of data points scaled from charts. The variation of the earth's magnetic moment and the location of the dipole axis since 1835 are described and discussed. An extrapolation of the geomagnetic field into the earth's interior is described. Author

N64-16285* RAND Corp., Santa Monica, Calif.
INTEGRAL AND SPHERICAL-HARMONIC ANALYSES OF THE GEOMAGNETIC FIELD FOR 1955.0, PART 2
E. H. Vestine, W. L. Sibley, J. W. Kern, and J. L. Carlstedt Repr. from J. Geomagnetism and Geoelectricity, v. 15, no. 2, 1963 p 73–89 refs
(NASA Contract NASr-21(05))

A numerical integration method for analyzing the geomagnetic field is developed from Poisson's integral. A new surface grid, suitable for use with integral analysis, is described. This grid is based on subdivisions of a spherical icosahedron, and its points are almost uniformly spaced over a sphere. This integration method is applied to calculations of field values, field lines, and conjugate points. The results are compared with those of earlier spherical-harmonic analyses by Vestine and Sibley. A comparison is also made between those conjugate points calculated by spherical harmonics from different sets of coefficients derived from various sets of isomagnetic charts. Author

N64-16347 Air Force Systems Command, Wright-Patterson AFB, Ohio
AN INVESTIGATION OF THE FINE STRUCTURE OF THE F LAYER OF THE IONOSPHERE
N. T. Tsymbal (Khar'kov Polytech. Inst.) 5 Mar. 1963 10 p refs Transl. into ENGLISH from Mezhdunar. Geofiz. God Inform. Byul., Akad. Nauk Ukr. RSR(Kiev), no. 3, 1961 p 19–23 (FTD-TT-62-1388/1+2+4; AD-298650)

Presented are the results of an experimental investigation of the degree of heterogeneity β_2 and angular scattering of waves reflected from the F-layer of the ionosphere. The rms velocities of the chaotic motion of the heterogeneities v_0 and their horizontal dimensions are determined. Author

N64-16451 Library of Congress, Washington, D.C. Aerospace Information Div.
IGY PAPERS ON TECTONICS, SEISMOLOGY, AND GRAVITY
3 Feb. 1964 65 p refs Transl. into ENGLISH of 9 papers from Geofiz. Byul. (USSR), no. 12, 1962 p 3–6, 10–13, 39–42, 61–84, 103–108, and 125–127
(AID-T-64-8; AD-430046) OTS: $6.60 ph, $2.15 mf

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7. THE ESTABLISHMENT OF A CRIMEAN GEOPHYSICAL POLYGON FOR THE STUDY OF THE ABYSSAL STRUCTURE OF THE EARTH'S CRUST AND RECENT TECTONIC MOVEMENTS A. A. Izotov, Yu. D. Bulanzhe, V. A. Magnitskiy, Yu. A. Meshcheryakov, and N. S. Blagovolin p 44–50 (See N64-16458 08-12)
8. THE THIRD INTERDEPARTMENTAL CONFERENCE ON THE PROBLEM OF RECENT TECTONIC MOVEMENTS OF THE EARTH'S CRUST L. Ye. Setunskaya and Ye. A. Fin'ko p 51–58 refs (See N64-16459 08-12)
9. PROCESSING AND PUBLICATION OF THE RESULTS OF OPTICAL OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES IN THE USSR N. P. Slovokhotova p 59–62 refs (See N64-16460 08-32)

N64-16452 Library of Congress, Washington, D.C. Aerospace Information Div.
STUDY OF THE RECENT MOVEMENTS OF THE EARTH'S CRUST [IZUCHENIYE SOVREMENNYKH DVIZHENIY ZEMNOY KORY]
Yu. D. Bulanzhe and Yu. A. Meshcheryakov *In its* IGY Papers on Tectonics, Seismology, and Gravity 3 Feb. 1964 p 1–6 (See N64-16451 08-12) OTS: $6.60 ph, $2.15 mf

Proposals are presented toward the achievement of the following three projects: (1) the compilation of a world map of the movements of the earth's crust; (2) the organization of an International Observation Service for the rate of movements of the earth's crust; and (3) the study of continental movements. I.v.L.

N64-16453 Library of Congress, Washington, D.C. Aerospace Information Div.
ON THE MEETING OF THE COMMITTEE ON INTERNATIONAL SEISMOLOGICAL SUMMARY [O SOVESHCHANII KOMITETA PO MEZHDUNARODNOY SEISMOLOGICHESKOY SVODKE]
N. V. Kondorskaya *In its* IGY Papers on Tectonics, Seismology, and Gravity 3 Feb. 1964 p 7–12 (See N64-16451 08-12) OTS: $6.60 ph, $2.15 mf

The following agenda items are discussed: (1) the scientific tasks confronting the ISS; (2) the standardization of seismic equipment and recording; (3) the disposition of stations, key stations, and regional centers; (4) data required from stations, data collection and transmittal to the centers, microfilms, and other copying devices; (5) the utilization of electronic computers; (6) publications; and (7) finances. I.v.L.

N64-16454 Library of Congress, Washington, D.C. Aerospace Information Div.
FIFTH CONFERENCE OF REPRESENTATIVES OF COUNTRIES OF THE EUROPEAN-ASIATIC REGION [PYATOYE SOVESHCHANIYE PREDSTAVITELEY STRAN EVROPEYSKO-AZIATSKOGO REGIONA]
Yu. D. Bulanzhe *In its* IGY Papers on Tectonics, Seismology, and Gravity 3 Feb. 1964 p 13–17 (See N64-16451 08-12) OTS: $6.60 ph, $2.15 mf

The most substantial results of the conference were the detailed recommendations worked out for the preparation and conduction of the IQSY and the Cloud Year and for the coordination of observations undertaken in connection with the realization of the Upper Mantle Project. The conference also made decisions concerning the international standardization of instrumentation and observation methods for oceanic studies and the coordination of oceanological investigations, particularly of the Baltic Sea and of the Atlantic Ocean. Delegates to the conference were given the opportunity to familiarize themselves with the activities of several of the scientific organizations of the Polish People's Republic: the Communications Institute of the Ministry of Communications, the Magnetic Observatory in Swider, the Astronomical Observatory of Torun University, and divisions of the Hydrometeorological Service at the Warsaw University. Several of these activities are listed. I.v.L.

N64-16455 Library of Congress, Washington, D.C. Aerospace Information Div.
GEOLOGICAL ACTIVITY OF THE EAST ANTARCTICA ICE SHEET [GEOLOGICHESKAYA DEYATEL'NOST' LEDNIKOVOGO POKROVA VOSTOCHNOY ANTARKTIDY]
S. A. Yevteyev *In its* IGY Papers on Tectonics, Seismology, and Gravity 3 Feb. 1964 p 18–28 (See N64-16451 08-12) OTS: $6.60 ph, $2.15 mf

The following examples of the action of ice on the bedrock surface of the East Antarctica are discussed: (1) the action of the glacier on the underlying surface; (2) the transport of morainic material by ice and the structure of the ice at the base of the East Antarctica ice sheet; (3) the deposition of morainic materials by the East Antarctica ice sheet; and (4) the history of the development of East Antarctica and the effect of glaciation. These examples show that, contrary to an earlier opinion, the ice sheet at the present time is capable of greatly transforming the relief of the underlying surface. During past phases of the ice sheet's development, when ice thicknesses were greater and the dimensions of the sheet in area were much larger, its action was even more vigorous. At the scales prevailing during the Quaternary period, changes produced by the scouring action of the ice sheet can be estimated in several tens of meters. A comparison between processes occurring at the present time in the Antarctica ice sheet with processes in ancient ice sheets of the Northern Hemisphere gives special importance to investigations of the Antarctica. It has made possible the establishment of a principle that governs the geological work concerning ice as based on a presently active ice sheet. I.v.L.

N64-16456 Library of Congress, Washington, D.C. Aerospace Information Div.
PROFILE THERMAL SOUNDING AND THE DELIMITATION OF GLACIER ZONES ON EL'BRUS [MARSHRUTNOYE TERMOZONDIROVANIYE I VYDELENIYE GLYATSIOLOGICHESKIKH ZON NA EL'BRUSE]
Ye. N. Teykin *In its* IGY Papers on Tectonics, Seismology and Gravity 3 Feb. 1964 p 29–34 refs (See N64-16451 08-12) OTS: $6.60 ph, $2.15 mf

Eleven boreholes were drilled between Priyut Pastukhova and the terminus of the Gara-Bashi glacier. Data were obtained from the boreholes on the structure and temperatures of the upper layers of the glacier. An analysis of these data, coupled with general information about the climate and snow cover, made it possible to distinguish four glacier zones and to trace, in the first approximation, the boundaries between these zones. The zones are as follows: (1) The zone of glacier feeding extends from elevations of the order of 5,300 to 4,000 m. It is characterized by the absence of a compact firn field. (2) The warm firn zone is situated at elevations from 4,000 to 3,800 m. It is covered by a thick firn formation that is interstratified with ice sometimes one-half meter thick. (3) The firn and ice zone is situated in the 3,800- to 3,700-m belt. The thickness of the firn in this zone is considerably less than the zone immediately above it, and rarely exceeds 3 to 4 m. (4) The ablation zone is situated below 3,700 m. The ablation in this zone exceeds the accumulation of material and is not homogeneous. I.v.L.

N64-16457 Library of Congress, Washington, D.C. Aerospace Information Div.
SECULAR VARIATIONS OF GRAVITY [VEKOVYYE IZMENENIYA SILY TYAZHESTI]
Yu. D. Bulanzhe *In its* IGY Papers on Tectonics, Seismology, and Gravity 3 Feb. 1964 p 35–43 refs (See N64-16451 08-12) OTS: $6.60 ph, $2.15 mf

A measurement method is proposed that may result in obtaining reliable information on the secular variation of gravity. A station is selected where the geological–geophysical conditions are such that gravity variations might be expected to occur. Two control stations are selected in such a way that the Δg between them and the main station will be close to zero, but will not exceed 10 milligals. These control stations should be located more than 500 km from the main station. It is desirable for the connection between the main and control stations to be made in chains consisting of several links. This can be done by a plane, helicopter, or by an automobile. The gravimeters used should be standardized to an accuracy of the order of 1×10^{-3}, and the cgs system should be used. I.v.L.

N64-16458 Library of Congress, Washington, D.C. Aerospace Information Div.
THE ESTABLISHMENT OF A CRIMEAN GEOPHYSICAL POLYGON FOR THE STUDY OF THE ABYSSAL STRUCTURE OF THE EARTH'S CRUST AND RECENT TECTONIC MOVEMENTS [O SOZDANII KRYMSKOGO GEOFIZICHESKOGO POLIGONA DLYA IZUCHENIYA GLUBINNOGO STROENIYA ZEMNOY KORY I SOVREMENNYKH TEKTONICHESKIKH DVIZHENIY]
A. A. Izotov, Yu D. Bulanzhe, V. A. Magnitskiy, Yu. A. Mesh-Cheryakov, and N. S. Blagovolin *In its* IGY Papers on Tectonics, Seismology, and Gravity 3 Feb. 1964 p 44–50 (See N64-16451 08-12) OTS: $6.60 ph, $2.15 mf

The establishment of a Crimean Geophysical Polygon is proposed. This report discusses the long-term systemic geophysical, geodetic, and geological–geomorphological investigations that will be conducted on the polygon. I.v.L.

N64-16459 Library of Congress, Washington, D.C. Aerospace Information Div.
THE THIRD INTERDEPARTMENTAL CONFERENCE ON THE PROBLEM OF RECENT TECTONIC MOVEMENTS OF THE EARTH'S CRUST [TRET'YE MEZHDUVEDOMSTVENNOYE SOVESHCHANIYE PO PROBLEME SOVREMENNYKH TEKTONICHESKIKH DVIZHENIY ZEMNOY KORY]

L. Ye. Setunskaya and Ye. A. Fin'ko *In its* IGY Papers on Tectonics, Seismology, and Gravity 3 Feb. 1964 p 51–58 refs (See N64-16451 08-12) OTS: $6.60 ph, $2.15 mf

Among the topics discussed at the conference were the following: secular movements of the earth's crust and some results and problems of the investigation; specific examples of the use of inclinometers to study the movements of the earth's crust in Central Asia; a geodetic method used in the study of recent tectonic movements; geophysical interpretation of data on recent tectonic movements; the origin of tectonic movements; continental drift; and international cooperation in the field of recent crustal-movement investigations. Also, excerpts from various reports, given at the sectional level (geodesy, geophysics, geology, and geomorphology), are presented. I.v.L.

N64-16485 American Meteorological Society, Boston, Mass.
A NEW MEASURE FOR THE FIELD STRENGTH OF THE GEOMAGNETIC EQUATORIAL RING CURRENT [EIN NEUES MASS FUR DIE FELDSTARKE DES ERDMAGNETISCHEN AQUATORIALEN RINGSTROMS]
W. Kertz Bedford, Mass., AFCRL [1963] 29 p refs Transl. into ENGLISH from Abhandl. Akad. Wiss. Gottingen, Math.-Physik. Kl., no. 2, 1958 p 5–16
(Contract AF 19(604)-6113)
(T-G-198; AD-430160)

The purpose of this project was to determine the time dependence of the ring current field for long periods of time. A procedure is described for deriving a measure of the ring current field, and other methods are outlined for obtaining values for shorter time intervals. E.W.

N64-16507 Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ELEVATIONS ON THE ICE SHEET OF SOUTHERN GREENLAND
Steven J. Mock and Richard H. Ragle Mar. 1963 16 p refs (Tech. Rept. 124)
(AD-430062)

A Corps of Engineers research expedition operating on the Greenland ice sheet during the summer months studied the stratigraphy, density, and temperature variations through the upper 10 m of snow and firn. Elevations of over 200 points on the ice sheet were determined from barometric readings taken by leapfrog altimeter techniques. These elevations are within ±50 ft of the true elevation and are consistently several hundred feet lower than those indicated on the latest World Aeronautical Charts. The theory and equations of the relationship between elevation and pressure, corrections for temperature, relative humidity, effect of variation of gravity, and cyclonic-induced pressure changes are shown. Equipment and methods used are described. Author

N64-16513 Joint Publications Research Service, Washington, D.C.
RECENT SOVIET PROGRESS IN MAGNETO-TELLURIC METHODS
6 Mar. 1964 45 p refs Transl. into ENGLISH of 7 articles from the book "Elektromagnitnoye Zondirovaniye i Magnitotellurgicheskiye Metody Razredki" Leningrad, Leningrad U. Publishing House, 1963
(JPRS-23548; OTS-64-21726) OTS: $1.25

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2. THE MAGNETO-TELLURIC METHOD FOR INVESTIGATION OF THE UPPER PART OF THE EARTH'S CRUST N. P. Vladimirov p 11–17 refs (See N64-16515 08-12)
3. THE OUTLOOK FOR DEEP MAGNETO-TELLURIC SOUNDING A. N. Tikhonov, N. V. Lipskaya, N. A. Deniskin, and N. N. Nikiforova p 18–26 refs (See N64-16516 08-12)
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7. A METHOD FOR THE USE OF MEAN-PERIOD PULSATIONS OF THE VERTICAL COMPONENTS OF THE GEOMAGNETIC FIELD AND THE HORIZONTAL COMPONENT OF EARTH CURRENTS FOR GEOPHYSICAL EXPLORATION p 42 (See N64-16520 08-12)

N64-16514 Joint Publications Research Service, Washington, D.C.
MAGNETO-TELLURIC SOUNDING IN THE REGION OF THE CENTRAL RUSSIAN DEPRESSION
B. Ye. Bryunelli, A. A. Kovtun, O. M. Raspopov, N. M. Rudneva, and N. D. Chicherina *In its* Recent Soviet Progr. in Magneto-Telluric Methods 6 Mar. 1964 p 1–10 refs (See N64-16513 08-12) OTS: $1.25

A magneto-telluric sounding method was developed and evaluated. In 1959 and 1960, sounding work was done using this method at two points in the Central Russian Depression (at Borok in Yaroslavskaya Oblast and at Temta in Gor'kovskaya Oblast). Records made of variations of the magnetic and electric fields indicate the following: In the upper layers, especially at Borok, there is an extremely thick layer of low resistivity. The presence of a conducting layer under the basement of the region was also demonstrated. It was shown that in order to obtain a sounding curve it is sufficient to have a 4- or 5-day around-the-clock record of geomagnetic variation. R.T.K.

N64-16515 Joint Publications Research Service, Washington, D.C.
THE MAGNETO-TELLURIC METHOD FOR INVESTIGATION OF THE UPPER PART OF THE EARTH'S CRUST
N. P. Vladimirov *In its* Recent Soviet Progr. in Magneto-Telluric Methods 6 Mar. 1964 p 11–17 refs (See N64-16513 08-12) OTS: $1.25

The magneto-telluric method of exploration was found to offer the possibility of studying the electric characteristics of deposits under sediments of virtually infinite resistivity, which act as a shield against electrical exploration by a d.c. current. The magneto-telluric sounding method was found to possess greater resolution than the d.c.-resistivity method. The investigations that were made demonstrated the need for continuing work on the development of a portable apparatus for the magneto-telluric method of exploration that could be used to study microvariations of the earth's natural electromagnetic field in the range of 0.1 to 1,000 cps. R.T.K.

N64-16516 Joint Publications Research Service, Washington, D.C.
THE OUTLOOK FOR DEEP MAGNETO-TELLURIC SOUNDING

A. N. Tikhonov, N. V. Lipskaya, N. A. Deniskin, and N. N. Nikiforova *In its* Recent Soviet Progr. in Magneto-Telluric Methods 6 Mar. 1964 p 18–26 refs (See N64-16513 08-12) OTS: $1.25

The history of the use of the magneto-telluric sounding method for determining the structure of the earth is presented, and the development of equipment suitable for recording the variations of the electromagnetic field in the required frequency range is discussed. Examples are given of typical curves of the apparent resistivity of the earth found by the method of magneto-telluric sounding; the electrical characteristic of a profile obtained in an interpretation of a deep magneto-telluric sounding curve is also included. R.T.K.

N64-16519 Joint Publications Research Service, Washington, D.C.

DEVELOPMENT OF METHODS OF MAGNETO-TELLURIC EXPLORATION AT THE ALL-UNION SCIENTIFIC RESEARCH INSTITUTE OF GEOPHYSICS

M. N. Berdichevskiy *In its* Recent Soviet Progr. in Magneto-Telluric Methods 6 Mar. 1964 p 40–41 (See N64-16513 08-12) OTS: $1.25

Investigations are being carried on in three principal areas: (1) improvements in the telluric currents method; (2) the development of equipment for magnetotelluric profiling; and (3) practical applications of the magnetotelluric sounding method. R.T.K.

N64-16520 Joint Publications Research Service, Washington, D.C.

A METHOD FOR THE USE OF MEAN-PERIOD PULSATIONS OF THE VERTICAL COMPONENTS OF THE GEOMAGNETIC FIELD AND THE HORIZONTAL COMPONENT OF EARTH CURRENTS FOR GEOPHYSICAL EXPLORATION

A. P. Bondarenko *In its* Recent Soviet Progr. in Magneto-Telluric Methods 6 Mar. 1964 p 42 (See N64-16513 08-12) OTS: $1.25

The method is based on the ratio of the time derivative of the vertical component of the magnetic field (H'_z) to the modulus of the horizontal component of the electric field. The phase difference of these values is not dependent on the geological structure of the area, but the ratio of the amplitudes is proportional to the resistance value. This ratio has been used as the principal exploratory parameter. The first experimental data, obtained at several points on the Russian platform and in the Carpathian foredeep, have confirmed these assumptions. R.T.K.

N64-16630 Texas Christian U., Fort Worth

HYDROTHERMAL SYNTHESIS OF R_2SiO_4 COMPOUNDS

Arthur J. Ehlmann Ft. Worth, Tex., Gen. Dyn., 15 Jan. 1964 11 p refs Work performed under contract with Gen. Dyn./Fort Worth, Tex.

(Contract AF 33(657)-11214)

(ERR-FW-221; AD-430515)

The forsterite–fayalite series is a complete solid solution series between Mg_2SiO_4 and Fe_2SiO_4. The series has been resynthesized by a new method. The starting materials were magnesium oxide, ferrous oxalate, and silicic acid. The mixtures were dried and ground, and then were sealed with a small amount of water in fine silver tubing. The silver capsule was placed in a pressure vessel and brought to the desired temperature and pressure. A summary of each run is given in a table. The products of each run were analyzed with a diffractometer to determine the phases present. The values of the X-ray data for the runs were used to derive the determination curve for the synthesized compounds. E.W.

N64-16722* Smithsonian Astrophysical Observatory, Cambridge, Mass.

INHOMOGENEOUS DISTRIBUTION OF THE RADIOACTIVE HEAT SOURCES. I. THEORY Research in Space Science

Chi-yuen Wang 3 Feb. 1964 24 p refs

(NASA Grant NsG-87-60)

(NASA CR-55852; SAO Special Rept. 143) OTS: $2.60 ph, $0.92 mf

The heat-flow analysis was based mainly on data summarized by Lee (1963). The heat-flow data were placed on IBM cards and then plotted on a global map. The data were then averaged over 10° x 10° squares and 20° x 20° squares. The averaging processes tended to bring down the amplitudes of the fluctuation indicated by individual data and to smooth out the values. The main results of the analyses are: (1) for the 10° x 10° averages, there appeared to be a strong correlation between the heat-flow values and some major geological structures; (2) for the 20° x 20° averages, there appeared to be certain correlations between the highs and the lows of the heat flow and the negative and positive geoid heights represented by the low-order spherical harmonics as obtained from satellite data; and (3) the coefficient of correlation was 0.5. R.T.K.

N64-16725* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

ROCKET SOUNDINGS IN THE MESOSPHERE

William Nordberg Nov. 1963 38 p refs Presented at the Meeting on Meteorol. Support for Aerospace Testing and Operation, Colo. State U., Ft. Collins, 10–12 Jul. 1963

(NASA TM X-54618; X-651-63-244) OTS: $3.60 ph, $1.34 mf

The following topics are discussed: (1) physics of the mesosphere; (2) experimental techniques—launch vehicles, radar tracking of chaff, sodium vapor ejection, acoustic grenades, falling sphere, pitot-static tube; (3) present rocket sounding programs; (4) results of recent rocket soundings—including a map of locations from rocket soundings in the mesosphere that have been conducted during and since IGY; a summary of mesosphere rocket soundings performed at Wallops Island, 1961 through 1963, showing time of launching; type of experiment and approximate range of actual data recovery for each sounding; average profiles of temperature versus altitude for winter and summer over Wallops Island, Va.; winter and summer densities as a function of altitude derived from individual temperature soundings obtained with the rocket grenade experiment over Wallops Island, Va.; winter and summer measurements of wind speed and direction versus altitude as measured by the grenade experiment over Wallops Island; comparisons of nearly simultaneous temperature measurements obtained with grenade, meteorological rocketsondes and radiosonde techniques; and comparison of densities obtained nearly simultaneously with the falling sphere, rocket grenade, and pitot-tube techniques on 6 June 1962, over Wallops Island. R.T.K.

N64-16731* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

ON THE INTERNAL CONSTITUTION OF THE TERRESTRIAL PLANETS

R. A. Lyttleton 21 Sep. 1963 70 p refs

(NASA Contract NAS7-100)

(NASA CR-53089; JPL-TR-32-522) OTS: $6.60 ph, $2.30 mf

The modern trend of ideas in the theory of the origin of the planets is toward the view that the Earth, other terrestrial planets, and the Moon formed in such a way that their internal

temperatures were sufficiently low initially for them to have been solid throughout. Subsequent rise in temperature could have resulted from the radioactive release of energy, and certainly in the case of the Earth, some such energy release in the deep interior would be postulated to account for the present existence of the liquid core. The similarity of Venus to the Earth, in regard to size and mass, suggests that Venus also probably has a liquid core. However, Mercury, Mars, and the Moon are so much smaller in mass that there is no reason to suppose that they possess central liquid cores. These internal conditions of the planets were arrived at by calculating the hydrostatic equilibrium of the planets and the Moon, using the relations between pressure and density of a two-zone, initially solid Earth. I.v.L.

N64-16743* Michigan U., Ann Arbor High Altitude Engineering Lab.
LONG-TERM INTEGRITY OF THE TIROS 5-CHANNEL RADIOMETER VISIBLE CHANNEL CHARACTERISTICS
F. L. Bartman, M. T. Surh, and M. G. Whybra Dec. 1963 41 p refs
(NASA Contract NASw-140)
(NASA CR-53105; Rept. 03615-13-1) OTS: $4.60 ph, $1.43 mf

During a 16-month period, the radiometer experienced approximately 75 hours of near-space environment on balloon flights of 22 miles' altitude and in environmental test chambers simulating conditions at 22 miles. Data from three sets of calibrations made during this time are shown to agree within the error of the measurements. The theory and method of making the calibrations are discussed. Author

N64-16804 Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
INVESTIGATING IONOSPHERIC DUCTING WITH THE *ORBIS* BEACON
John P. Mullen, Gerald Daniels, and Richard Allen Jan. 1964 19 p refs
(AFCRL-64-29; AD-430420)

An experiment is described that uses a satellite-borne, two-frequency HF beacon to perform a synoptic investigation of ionospheric ducting. The expected ducting modes are described qualitatively and quantitatively using the AFCRL ray-tracing computers. System calculations, based upon estimated ionospheric parameters, are contained in the Appendix. Author

N64-16837 Aracon Geophysics Co., Concord, Mass.
MAGNETOHYDRODYNAMIC WAVE PROPAGATION AND BOUNDARY VALUE PROBLEMS IN THE LOWER IONOSPHERE Report No. 12 (Eighth Quarterly Letter Report) [1 Jan.-29 Feb. 1964]
Robert F. Smiley 25 Feb. 1964 5 p refs
(Contract DA-36-039-SC-89177; ARPA Order 163)
(ARA-T-9197-12; AD-432131)

Progress reported includes: (1) Numerical results were obtained, by means of the IBM-7090 digital-computer program, for both incident modified Alfvén (ordinary) waves and incident Alfvén (extraordinary) waves. These results consist principally of the magnetic-field amplitude at the surface of the earth and of the amplitudes and energy fluxes of the two possible reflected waves. (2) A significant theoretical conclusion concerning the prediction of geomagnetic micropulsation effects of high-altitude nuclear detonations has been reached. This conclusion is that the first magnetic pulse caused by a high-altitude detonation (in about the first 2 seconds after detonation) should vary spatially over the earth in the same manner as the magnetostatic field of a magnetic dipole, with a magnetic north–south axis, inside a thin spherical shell bounded by perfectly conducting walls. This, in turn, implies that the intensity of the first-pulse resultant magnetic field is independent of direction from the detonation point and varies with great circle distance from the burst point according to the equation: $B = A/\sin^2(\theta/2)$, where $\theta = r/R$, B is the resultant magnetic field at a receiver on the surface of the earth, r is a great-circle distance from burst to receiver, θ is a great circle angle in radians from burst to receiver, R is the earth's radius, and A is a constant for a given burst. I.v.L.

N64-16850 Avco Corp., Wilmington, Mass. Research and Advanced Development Div.
ANTARCTIC RESEARCH AND DATA ANALYSIS. ATMOSPHERIC RADIO NOISE AT BYRD STATION, ANTARCTICA Scientific Report 9, Mar. 1958–Dec. 1959
John R. Herman 27 Dec. 1963 61 p refs
(Contract NSF-C255)
(RAD-TR-63-46)

Since no thunderstorms occur at Byrd, the atmospheric noise is received only by ionospheric propagation modes from distant sources, such as the major active centers in Central Africa, the East Indies, and Central and South America. It is shown that the noise level is affected by both changes in world thunderstorm activity and in propagation factors. In the high-frequency band the noise sources in Central and South America are the major contributors to the noise power measured at Byrd Station. A "noise index" is defined and used to select periods of anomalous absorption. Fourteen polar cap absorption (PCA) events are detected by the index, all of which have been previously reported on the basis of northern hemisphere observations. It is shown that the hf noise level at Byrd is severely depressed during PCA, especially on 5.0 and 10 mc. Author

N64-16875 Aerospace Corp., El Segundo, Calif. Systems Research and Planning Div.
SOME FREQUENTLY USED FORMS OF THE EARTH'S GRAVITY POTENTIAL
P. T. Guttman 31 Jan. 1964 13 p refs
(Contract AF 04(695)-269)
(TDR-269(4550-10)-5; SSD-TDR-63-337; AD-431845)

The purpose of this report is to summarize the nomenclature and the forms of the earth's gravity potential in order to clarify and standardize the information for those who desire to keep abreast of the developments in this area of study. Author

N64-16893 Cornell Aeronautical Lab., Inc., N.Y.
PROJECT FLAYER III: A STUDY OF SPREAD-F ECHOES FROM THE IONOSPHERE Final Report
Jacques Renau and W. A. Flood Aug. 1963 48 p refs
(Contract AF 19(628)-351)
(CAL RA-1684-P-1; AD-430349)

Techniques for measuring the cone angle of arrival of radio waves, experimental equipment used in the study, and experimental results obtained are discussed. Analysis of 44 cases of spread-F echoes at 2.4 mc resulted in the following conclusions: (1) The width of the video fading spectrum is commonly less than 1/2 cps although occasionally some of the spectra are as wide as 1 cps with much weaker components at 2 cps. (2) The amplitude distributions of spread-F echoes at 2.4 mc obtained from 1-minute data runs are Rayleigh or Rice distributed only for the strongest and lower altitude echoes.

The echoes from the largest slant ranges (and presumably higher altitudes) are neither Rayleigh nor Rice distributed, and show an unexpectedly large proportion of small or zero amplitude signals that suggest a sporadic nature of spread-F echoes. (3) The amplitude correlation coefficient evaluated at a 1,700 ft (≈4 wavelength) spacing is typically much less than 0.4, implying that the cone angle of spread-F echoes is commonly greater than 5°. P.V.E.

13 HEAT TRANSFER AND THERMODYNAMICS

Includes ablation; cooling; heating; and other thermal effects. *For aerothermodynamics see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings, Rotors, and Control Surfaces. *For combustion see*: 26 Propellants and Combustion. *For related information see*: 11 Fluid Mechanics.

N64-16119* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE TOTAL ENTHALPY OF A ONE-DIMENSIONAL NOZZLE FLOW WITH VARIOUS GASES

Leland H. Jorgensen Washington, NASA, Mar. 1964 18 p refs (NASA TN D-2233) OTS: $0.50

Real-gas thermal properties are used in a method for determining the total enthalpy of a one-dimensional nozzle stream as a function of a simple parameter that includes weight–flow rate, throat area, and total pressure. For a total enthalpy range from about 200 to 10,000 Btu/lb and for total pressures from 1 to 100 atmospheres, charts determined by the method are presented for the case of equilibrium flow of air, nitrogen, carbon dioxide, and argon. Curves for frozen airflow are also included. Author

N64-16213 France. Ministère de l'Air, Paris

TRANSACTIONS OF THE AEROTHERMAL SEMINAR OF THE PARIS FACULTY OF SCIENCES (1958-1961) [ACTES DU SEMINAIRE D'AEROTHERMIQUE DE LA FACULTE DES SCIENCES DE PARIS (1958-1961)]

Edmond A. Brun, ed. Serv. de Doc. Sci. et Tech. de l'Armement 1963 131 p refs In FRENCH

(*Its* Publ. Sci. et Tech. No. NT-129)

Discussions of the following topics are presented: (1) hypersonic installations at Fort Halstead; (2) considerations concerning the flow regimes between a continuum flow and a free-molecular flow; (3) a study of the stability of the Couette flow; (4) the state-of-the-art of present-day knowledge of explosives; (5) techniques for measuring the dynamics of rarefied gases; (6) the study of the formation of detonation waves; (7) an experimental study of the natural convection and of the radiation at the rough surface of a horizontal cylinder; (8) new perspectives for the use of resistance strips as extensometers; (9) the interaction of radiation and convection in detached shock layers; (10) the parameters of dimensionless radiation in gas dynamics; (11) the relationship between thermodynamics and the information theory; and (12) new aspects and results of the approximation theory of limited laminar and turbulent boundary layers. I.v.L.

N64-16251 Gt. Brit. Ministry of Aviation, Mottingham Technical Information and Library Services

THE EFFECT OF THE TEMPERATURE RATIO ON HEAT TRANSFER [VLIYANIE TEMPERATURNOGO FAKTORA NA TEPLOOTDACHU]

I. V. Dubrovin Jan. 1964 11 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 2, 1960 p 69–74

(TIL/T.5476)

An analysis of existing methods is given, and a new method is proposed for assessing the effect of temperature ratio on heat transfer. The analysis refers to "in-line" arrangements of heat-exchange pipes. Author

N64-16361 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PRODUCTION OF LOW TEMPERATURES

Dzso Novak 21 May 1961 37 p Transl. into ENGLISH from Fiz. Szemle (Budapest) v. 12, no. 7, 1962 p 206–219

(FTD-TT-63-268/1+2+3+4; AD-409703)

A brief discussion is presented of the methods used in the liquefaction of gases and includes the following topics: (1) cooling processes; (2) first attempts at liquefaction of gases; (3) cooling of gases with isentropic expansion; (4) the Joule-Thomson effect; (5) practical accomplishment of gas liquefaction—refrigerating machines, the cascade liquefier, Linde-type liquefiers, liquefaction of gases with isentropic work, and low-temperature storage of liquids and their industrial and scientific applications; (6) cooling methods for production of temperatures between 1° and 10^{-3}° K—adiabatic demagnetization, adiabatic magnetization of superconductors, thermoelectric cooling, cooling with the heat of solution of the isotope helium-3, and helium-3 cryostats; and (7) temperatures below 10^{-3}° K. P.V.E.

N64-16363 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SUBLIMATION OF A BLUNT BODY IN THE VICINITY OF THE STAGNATION POINT IN PLANE AND AXISYMMETRICAL FLOW OF GAS MIXTURE

G. A. Tirskiy 24 May 1963 31 p refs Transl. into ENGLISH from Zh. Vychislitel'no Mat. i Mat. Fiz. (Moscow), v. 1, no. 5, 1961 p 884–902

(FTD-TT-63-311/1+2+4; AD-409954)

An accurate solution (solution of the type of a uniformly propagating wave) is presented of the problem of equilibrium and nonequilibrium of a blunt body in the stagnation region, with an arbitrary dependence of the physical properties of the body on temperature. The solution was obtained numerically for a Prandtl number $\sigma = 0.7$ and $\sigma = 1$, and for a Schmidt number $Sc = 1$. A solution was also obtained for an arbitrary σ and $Sc > 0.5$ by means of asymptotic integration. It was demonstrated that if the coefficient of accommodation $f > 0.1$, then, with sufficient accuracy for application, the vaporization of the body will proceed according to diffusion kinetics (equilibrium vaporization) for $u_\infty \sim 10^3$ m/sec. When $f < 0.1$, nonequilibrium vaporization must be taken into account. The necessary and sufficient condition under which boiling at the sublimation front takes place was obtained. The temperature profiles in the body, for an arbitrary dependence of the thermophysical properties of the body on temperature, are found in quadratures. The calculation of any specific problem, in the general case, reduces to a solution of a system of three finite equations for the determination of the concentration, of the temperature at the vaporization front, and of the rate of sublimation. I.v.L.

N64-16365 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FREEZING OUT MOISTURE AND CARBON DIOXIDE IN TUBULAR HEAT EXCHANGERS

G. V. Vasyunina and L. S. Aksel'rod 26 Jul. 1963 34 p refs Transl. into ENGLISH from a Russian book "Apparaty i Mashiny Kislorodnykh Ustanovok" Vesesoyuznyi Nauchno-Issled. Inst. Kislorodn. Mashinostr. (USSR) no. 4, 1961 p 184–207
(FTD-TT-63-320/1+2+4; AD-418210)

Results are reported on an experimental investigation of certain fundamental questions connected with the operation of moisture and carbon dioxide freezers in air separators. Discussed are the amount of frozen component at the freezer outlet; the heat transfer through the surface covered by frost, tests on a high-pressure testing unit, and the freezing out of carbon dioxide and low pressure moisture. C.L.W.

N64-16374 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

EXPERIMENTAL RESEARCH ON THE EVAPORATION RATE OF A DROP OF LIQUID IN A STATIONARY HIGH-TEMPERATURE MEDIUM

V. M. Ivanov and Ye. V. Smirnova 3 Jul. 1963 24 p refs Transl. into ENGLISH from Tr. Inst. Goryuch. Iskop., Akad. Nauk SSSR, v. 19, 1962 p 46–58
(FTD-TT-63-520/1+2+4; AD-412976)

Measured was the evaporation rate of a drop of water 0.9 to 2.9 mm in diameter in a stationary medium 400° to 860° C [more accurately, with small Reynolds numbers (Re = 0.1 to 0.3)] in a cylinder with radiating walls. It was established that the evaporation rate of a drop of water at constant temperature is proportional to the radius of the drop to the 1.75 power. A rise in the chamber temperature is accompanied by a significant increase of the evaporation rate. The coefficient of heat transfer to the drop increases with an increase of the temperature of the medium. With a rise in temperature from 400° to 860° C the heat-transfer coefficient doubles. Author

N64-16407 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

HEAT TRANSFER IN A TURBULENT FLUID FLOW AT LARGE PRANDTL NUMBERS AND VARIABLE VISCOSITY

Ts'ai K'uo-en 11 p refs Transl. into ENGLISH from Inzh.-fiz. Zh., v. 5, no. 8, 1962 p 10–16
(FTD-TT-62-1890/1+2+4; AD-298652)

This article examines the problem of heat transfer in a turbulent fluid flow at large Prandtl numbers with consideration of the temperature effect on the change in viscosity. Expressions are derived for velocity and temperature distribution in the flow. Author

N64-16413 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CALCULATING THERMAL BOUNDARY LAYER IN A FLOW OF COMPRESSIBLE GAS

L. M. Zysina-Molozhen 3 Apr. 1963 10 p refs Transl. into ENGLISH from Inzhenerno-Fiz. Zh. (Minsk), no. 6, 1962 p 21–26
(FTD-TT-63-84/1+2; AD-402588)

An approximate semiempirical method is discussed for calculating laminar, transient, and turbulent zones of the thermal boundary layer, formed when a flow of compressible gas is directed around a surface. E.W.

N64-16471 Army Missile Command, Huntsville, Ala. Physical Science Lab.

THEORY OF LIQUID ABLATION

B. Steverding 22 Oct. 1963 50 p refs
(RR-TR-63-24; AD-427082)

A mechanism for preferential ablation is described and calculated for the simple case where loss by evaporation is large, compared with the loss by flow. The efficiency of liquid ablation can be increased by surface activity. The degree of improvement depends upon the parameter k/Dn and the activity coefficient of the surface-active compound in the liquid glass. The analysis is carried out in the vicinity of the stagnation point of a blunt body for glassy ablation materials. Author

N64-16480 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A NUMERICAL SOLUTION OF THE HEAT TRANSFER EQUATION

Sh. Ye. Mikeladze 15 May 1963 66 p refs Transl. into ENGLISH from Tr. Tbilissk. Mat. Inst., AN Gruzin SSR (Tiflis), v. 27, 1960 p 367–410
(FTD-TT-63-196/1+2+4; AD-409755)

A method of constructing a system of linear algebraic equations that relates the unknown functions in the nodes of any two successive layers is derived. The method is applicable to one-, two-, and three-dimensional cases. It is demonstrated that the derived system of equations can be solved by iteration, the convergence of the iterative process being ensured for any initial values by appropriate selection of time and space steps from the interval or intervals of change in them. Formulas are derived for rhombic networks. From these, the formulas for rectangular and hexagonal networks are obtained, and the solution errors are estimated. Accurate formulas are derived for boundary conditions of the general type. R.T.K.

N64-16508 AiResearch Mfg. Co., Los Angeles, Calif.

VEIL COOLING OF RADIAL-FLOW TURBINES Supplemental Report

M. Branger 24 Jan. 1964 5 p refs
(Contract Nonr-3685(00))
(K-518; AD-430571)

The effect of an inlet temperature of 1,500° F on the flow rate of a nozzle with a coolant passage exit width of 0.032 in. was investigated, and the results are presented in graphic form. R.T.K.

N64-16552 Monsanto Research Corp., Dayton, Ohio

BIPHENYL LIQUID HEAT TRANSFER AND VAPOR DEPOSITION STUDIES AT 700° AND 800° F Final Report, Feb. 9, 1961–May 31, 1963

C. D. King, Jr. and W. J. Moodie Washington, AEC, Div. of Tech. Inform., 1 Aug. 1963 99 p refs
(Contract AT(10-1)-1088)
(AEC-IDO-11006) OTS: $2.25

Heat-transfer studies were made on biphenyl in a large stainless steel heat-transfer test loop (1-in.-ID × 5-ft-long heat-transfer section). Correlations were developed for both convective and boiling heat transfer, including surface and bulk boiling, over the temperature range 413.0° to 805.5° F at heat fluxes from 10,600 to 110,200 Btu/hr × ft^2. A Dittus–Boelter-type equation was used to correlate the convective data, and a Levy-type equation was used for the boiling data. Turbine construction alloys were found to be unaffected by 320-hr exposure to high-velocity superheated biphenyl vapor at 700° F. An IBM-704 computer program was written for calculation of heat transfer and flow rates under thermosiphon conditions. Author

N64-16710* California U., Berkeley Aeronautical Sciences Lab.
RADIATIVE ENERGY TRANSFER TO OUTER BASE REGIONS OF CYLINDRICAL AND CONICAL GAS BODIES
C. L. Tien and M. M. Abu-Romia 24 Oct. 1963 77 p refs
(NASA Contract NAS8-850)
(NASA CR-55832; AS-63-4) OTS: $7.60 ph, $2.51 mf

The radiative energy transfer to the base regions of a rocket from exhaust plumes is studied analytically by considering the radiation from semi-infinite cylindrical and infinite conical gas bodies of uniform temperature and composition. The effect of nozzle shielding is considered. The results are in terms of the local apparent emissivity in the base region. The expression for the spectral apparent emissivity is in the integral form and requires in general a numerical integration. For semi-infinite cylindrical gas bodies of small absorption coefficient, two asymptotic formulas obtained by direct integration are given. Numerical results are presented for the spectral apparent emissivity as a function of the cone angle that is zero for a cylinder, the height of shielding, the spectral absorption coefficient, and the radial distance in the base plane from the gas body. Author

N64-16879 McDonnell Aircraft Corp., St. Louis, Mo.
ABLATION SHIELD DEVELOPMENT TESTING–SURFACE PREPARATION OF BERYLLIUM FOR ADHESIVE BONDING Final Report
Henry E. Ruling 10 Mar. 1964 22 p
(Contract AF 33(657)-11215)
(A471; AD-431621)

The optimum surface preparation method selected for adhesive bonding of beryllium consists of the following basic procedures (1) vapor degreasing, (2) liquid honing, and (3) alkaline cleaning. This method was selected on the basis of comparative lap shear strength tests. Also taken into consideration in the final analysis was the production setups required to accomplish the various surface preparation methods. The selected method does not require elaborate production setups or acid solutions. Author

N64-16880 McDonnell Aircraft Corp., St. Louis, Mo.
ABLATION SHIELD DEVELOPMENT TESTING – ADHESIVE EVALUATION AND ELEVATED TEMPERATURE PROPERTIES Final Report
Henry E. Ruling 10 Mar. 1964 22 p
(Contract AF 33(657)-11215)
(A472; AD-431509)

Surfaces of beryllium finger panels were processed for adhesive bonding by the optimum surface preparation method established by a previous test of this development program. Various film adhesives and bonding methods for each adhesive were then used in bonding the beryllium finger panels together. After bond line curing the bonded finger panels were machined into individual lap shear tension test specimens. Test specimens were subjected to a series of tests for adhesive shear strength at room and elevated temperatures. Although the lap shear strength of HT-424 film adhesive was lower than other adhesives tested at room temperature and 500° F, its greater strength at 650° F and 800° F makes it the most desirable adhesive for use in bonding applications involving beryllium and high-temperature environments. Author

14 HUMAN BEHAVIOR

Includes crew training and evaluation; piloting; and psychological factors. *For simulators see*: 10 Facilities, Research and Support. *For related information see*: 16 Life Sciences.

N64-16206 France. Ministere de l'Air, Paris
A GRAPHOLOGICAL CONTRIBUTION FOR SELECTION OF MILITARY PILOTS [CONTRIBUTION GRAPHOLOGIQUE A LA SELECTION DES PILOTES MILITAIRES]
Jean Gaussin [8 Oct. 1962] 35 p In FRENCH

The contribution of graphology to the selection of military pilots is reviewed. The success of a military pilot depends essentially on the quality of his motivations, and these motivations are not easily detected even by vigorous psychological techniques. However, graphology contributes considerably in the discovery of motivations; it gives a realistic account of the pilot's aptitudes and potentialities. If graphology were concerned only with checking the results in a correlated test system, the reliability of the diagnosis would be considerably increased. The triad graphological–morphological–characterological questionnaire, for example, has proven itself in industry in hiring and promotion practices. I.v.L.

N64-16330* Naval School of Aviation Medicine, Pensacola, Fla.
REDUCTION OF NYSTAGMUS AND DISORIENTATION IN HUMAN SUBJECTS Joint Research Report
Frederick E. Guedry Jr., Ashton Graybiel, and William E. Collins 19 Jun. 1962 11 p
(NASA Order R-47)
(NASA CR-55756; Rept. 69) OTS: $1.60 ph, $0.80 mf

Nystagmus, disorientation, and nausea were reduced in subjects living and moving about for several days in a slowly rotating room. The reduced nystagmus was not reinstated by assigning "arousal-tasks," which are ordinarily effective in this respect. After rotation was stopped residual effects were noted for several hours. These included compensatory nystagmus, compensatory illusory reactions, and some motion sickness. Other subjects were exposed to similar circumstances for shorter periods where only restricted head movements in a particular plane were permitted. Nystagmus, illusory phenomena, and nausea were reduced by this procedure. However, the habituation did not transfer to forms of vestibular stimulation, including head movements in an "unpracticed quadrant," that produce reactions similar in direction and plane to those repeatedly experienced during the habituation period. Residual effects from this shorter more restricted exposure were slight. Author

N64-16331* Naval School of Aviation Medicine, Pensacola, Fla.
A BRIEF VESTIBULAR DISORIENTATION TEST Joint Research Report
Charles S. Harris, Rosalie K. Ambler, and Fred E. Guedry, Jr. 1 May 1963 13 p refs
(NASA Order R-47; Proj. MR005.13-6001)
(NASA CR-55784; Rept. 82) OTS: $1.60 ph, $0.80 mf

One hundred and fourteen naval aviation cadets were evaluated on their reactions to Coriolis accelerations produced by head movements in a rotating chair. Three different measures were obtained: (1) rating by four independent raters, (2) self-ratings, and (3) a Semantic Differential Form designed to

measure the meaning of the experience to the subjects. Significant correlations were obtained among the raters and also among the three different measures. Evidence was obtained for a reliability test and one possessing construct validity.
Author

N64-16398 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
95 HOURS IN COSMOS
In its Nature (Selected Articles) 16 Nov. 1962 p 6–12 (See N64-16397 08-29)

The flight of Vostok III, piloted by cosmonaut A. G. Nikolayev, lasted 95 hours, i.e., almost four diurnal periods. During this time, the spacecraft flew more than 64 times around the earth, covering a distance of more than 2.6 million km. The flight duration of Vostok IV, piloted by cosmonaut P. R. Popovich, was 71 hours. The spacecraft flew more than 48 times around the earth, covering a distance of about 2 million km. The two spacecraft were in group flight for about 71 hours, i.e., for almost three diurnal periods. Diaries of these flights are presented. I.v.L.

N64-16399 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WE LIVED AND WORKED IN THE COSMOS
A. G. Nikolayev and P. R. Popovich *In its* Nature (Selected Articles) 16 Nov. 1962 p 17–27 (See N64-16397 08-29)

A. G. Nikolayev discusses his flight and that of Popovich in Vostok III and IV, respectively. He relates that neither he nor his fellow cosmonaut had any vestibular disorders during the entire flight, and that they ate and slept well. He speaks of their communications while in flight and of the tasks that they performed. Nikolayev reports that, from his spacecraft window, he was able to see shore lines and the outlines of cities by day, and that by night he could see the boundaries of cities and their streets. He describes the ablation of the spacecraft coating during reentry, his separation from his spacecraft, and his descent, by parachute, to earth. I.v.L.

N64-16489 Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y.
HUMAN TRACKING ABILITY FOR MAXIMUM TERRAIN FOLLOWING (PROJECT DIRECT) Final Report
W. J. Ruby and R. A. Monty 31 Aug. 1963 81 p refs
(Contract N600(10)-58660)
(CAL-IH-1715-E-5; AD-431116)

Two command signals were examined—the aircraft flight vector angle and the elevation angle. Each of the signals was computed for three aircraft speeds, 0.6, 0.75, and 0.9M, over two terrains—Southern Pennsylvania and the Rocky Mountains. A group of 12 subjects was randomly assigned to each command signal. Each subject flew each combination of aircraft speed and terrain (16 combinations) on each of 3 successive days. Three measures of performance were used, namely, integrated tracking error, normalized average clearance, and normalized average offset. It was found that the interpretation of the results was a function of the particular performance measure employed. That is, whereas integrated tracking error as significantly affected by both speed and terrain, normalized average clearances were a function only of terrain, and normalized average offsets were not affected by either speed or terrain. Also, terrain following (defined as a flight path that matches the terrain profile as closely as possible) and terrain avoidance systems are discussed. I.v.L.

N64-16534* National Aeronautics and Space Administration, Washington, D.C.
HUMAN TRACKING PERFORMANCE UNDER TRANSVERSE ACCELERATIONS
L. G. Summers and A. A. Burrows (Douglas Aircraft Co.) Feb. 1964 83 p refs Previously published as NASA CR-52718; see N64-11111 02-14
(NASA Contract NASr-68)
(NASA CR-21; NASA CR-52718) OTS: $2.25

Human performance was measured for control display parameters during positive and negative transverse acceleration ("eyeballs in" and "eyeballs out"). Five subjects were given a compensatory tracking task in pitch and roll using a two-axis sidearm controller and a CRT attitude display with a moving horizon. Three acceleration levels were used, each of two-minute duration. Performance was measured by the integral of absolute error in both the pitch and roll axes. There was a decrement in performance in the pitch axis with increased acceleration, but differences in the roll axis were shown only for one analysis model of two. No differences were recorded in performance due to direction of the acceleration. Physical control characteristics, such as preload and spring constant, did not affect performance or interact with acceleration. Aircraft dynamics affected performance but did not interact with acceleration. Author

N64-16640 School of Aerospace Medicine, Brooks AFB, Tex.
PHYSIOLOGIC EFFECTS OF EXPOSURE TO INCREASED OXYGEN TENSION AT 5 P.S.I.A.
T. E. Morgan, Jr., R. G. Cutler, E. G. Shaw, F. Ulvedal, J. J. Hargreaves et al Oct. 1963 15 p refs
(SAM-TDR-63-64; AD-430518) OTS: $1.10

Data were obtained during two 14-day experiments in the USAF SAM two-man space cabin simulator relative to the physiological factors in atmosphere selection. Both experiments were conducted at a simulated altitude of 27,000 feet (258 mm Hg) and a Po_2 of 243 mm Hg. Emphasis was placed on arterial and alveolar Po_2 and Pco_2, chest X-rays, and vital capacity, all determined at the experimental altitude and atmosphere. The atmosphere, in general, was well tolerated by all 4 tests subjects. No atelectasis was made evident by X-ray or by changes in vital capacity. Although vital capacity was reduced an average of 2.9%, this was not felt to be indicative of atelectasis. Arterial Po_2 was slightly lowered but, again, it did not indicate a significant increase in the normal physiologic shunting of blood. Author

N64-16648 North American Aviation, Inc., Columbus, Ohio
FLIGHT SIMULATOR STUDY OF HUMAN PERFORMANCE DURING LOW-ALTITUDE, HIGH-SPEED FLIGHT
Robert L. Brugh and James G. Mc Hugh Ft. Eustis, Va., Army Transportation Res. Command, Nov. 1963 119 p refs
(Contract DA 44-177-TC-803)
(TRECOM-TR-63-52; AD-431739) OTS: $10.10

An investigation of the influence of low-altitude high-speed flight conditions on inflight operator performance of surveillance-centered tasks is reported. Six Army pilots and four Army observers "flew" approximately 278 hours on simulated three-hour missions involving five rms gust-intensity levels and two airspeeds. The flights were made in a moving-base simulator that had a total travel of approximately 12 ft, an acceleration capability of ±6 g, a functional control system, and an associated analog computer for obtaining solutions to equations of motion of a mechanized aircraft. Data were analyzed in terms of human performance aspects of the missions. Author

N64-16667 Joint Publications Research Service, Washington, D.C.

ORGANIZATION OF WORK IN ENGINEERING PSYCHOLOGY IN THE USA

A. I. Nazarov 28 Feb. 1964 Transl. into ENGLISH of an article from Vopr. Psikhologii (Moscow), no. 5, 1963 p 176–186

(JPRS-23448; OTS-64-21682) OTS: $0.75

The aspects of engineering psychology discussed include: (1) scope and terminology; (2) trends; (3) basic stages in development; (4) problems in the organization of research; and (5) research conducted in various industrial firms in the USA. R.T.K.

N64-16728 Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Research Inst.

EXPERIMENTAL EVALUATION OF WORK CAPACITY AS RELATED TO CHRONOLOGICAL AND PHYSIOLOGICAL AGING

Bruno Balke Sep. 1963 8 p refs

(CARI-63-18)

The attainment and maintenance of a high level of work capacity requires frequent exposures to sufficiently high functional demands. Within this concept, two situations under experimental scrutiny are of interest: first, physiological parameters, indicative of physical performance capacity, were intra-individually measured over the years, whereby changes of work capacity became apparent as consequence of training, environment, inactivity, disease, and retraining. Retraining restored the functional adaptability at age 56 to nearly that observed at age 20 to 30. In the second situation, an individual (age 53) with essential hypertension, a disease considered to be associated with aging processes of vascular tissue, has been studied over months with results encouraging the application of an individually devised program of regular activities for the mitigation of such condition. Author

N64-16799 Ohio State U., Columbus Lab. of Aviation Psychology

TERM EXPECTATION AND UNCERTAINTY IN HUMAN DECISION BEHAVIOR

Jerry D. Tate, William C. Howell and Karl L. Wiegand (Aerospace Med. Div.) Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs. (6570th), Nov. 1963 24 p refs

(Contract AF 33(616)-7122)

(AMRL-TDR-63-118; AD-431634) OTS: $0.75

This study was conducted to investigate the manner and degree to which a decision maker's sequence of decisions is influenced by objectives of varying remoteness (term expectation) and by informational uncertainty. The effects of these two variables on sequential decision performance were studied in a 4 × 4 factorial experiment. Decisions (predictions) were made either at prescribed uncertainty levels or on a freely chosen basis (depending on the prevailing experimental conditions), and a range of choices varying in degree of risk and payoff was available at each uncertainty level. The same five subjects served in all conditions of the experiment. Choices were evaluated in terms of risk, expected value, and average departure from linear progression to mean winning score (DFL). The DFL analysis suggested that factors more immediate than term expectation heavily influence decisions. Author

N64-16802 University Coll., London (Gt. Brit.)

Progress Report, July 1963 [PHONETICS: STUDIES OF BRITISH, HUNGARIAN, AND GERMAN SPEECH]

D. C. Bennett et al [1963] 41 p refs

(AF EOAR Grant 62-112)

(AFCRL-64-86; AD-430704)

Contained in this report are discussions of the following: (1) a study of the formants—frequency regions of high-energy concentration corresponding to the passbands of the throat and mouth cavities—of the pure vowels of British English; (2) formant frequencies of Hungarian vowels; (3) an experimental study of the relative contributions of vowel duration and spectral form to the recognition of English and German pure vowels; (4) an investigation of the possibility that the sensation of pitch is partly dependent on a central temporal patterning of neutrally borne information about the waveforms of acoustic stimuli; (5) a long-term spectral analysis of random signals; (6) the SPYL, a combination of an instantaneous spectrograph, step analyzer, and a tape loop; (7) a spectrographic assessment of reverberation; (8) seven-volt Zener diodes as a satisfactory source of white noise over the audiofrequency spectrum; and (9) an apparatus for wow and flutter measurement, consisting of an oscillator that can be switched to function as a selective amplifier, a limiter, and a discriminator. The apparatus is to be used in conjunction with a Bruel & Kjaer level recorder in measuring the speed constancy of tape recorders. I.v.L

N64-16085 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

MEASURING AMOUNT OF PRIOR EXPOSURE TO MEANINGFUL WORDS

John F. Wing Oct. 1963 53 p refs

(AMRL-TDR-63-94; AD-431206) OTS: $1.25

An important aspect of psychological research on verbal behavior is precise knowledge of the characteristics of the verbal stimuli being used, especially the amount of prior exposure subjects have had to the stimuli. It is impossible to determine directly just how much prior exposure subjects have had to meaningful words, such as those used in everyday communications. Therefore, some indirect measure must be employed. This report describes and compares four possible indirect measures of prior exposure that experimenters may use: frequency of usage (F); judged familiarity (*f*); meaningfulness (*m*); and degree of polarization (D_4). Reliability coefficients are given for each measure (when available), as well as the intercorrelations between the four measures. Finally, a comparison is made of the four measures against certain criteria important to research on verbal performance. Author

N64-16811 Ohio State U., Columbus, Ohio Lab. of Aviation Psychology

EFFECTS OF MODIFIED TASK FEEDBACK DURING TRAINING ON PERFORMANCE OF A SIMULATED ATTITUDE CONTROL TASK AFTER THIRTY DAYS Technical Report, Sep. 1962-Aug. 1963

Robert Buckhout, James C. Naylor, and George E. Briggs Wright-Patterson AFB, Ohio, Behavioral Sci. Lab., Dec. 1963 28 p refs

(Contract AF 33(657)-10081)

(AMRL-TDR-63-125; AD-431215)

The criterion task consisted of compensatory rate tracking in three dimensions by means of "noisy" meter displays and a conventional stick with a twist dimension added. In addition, the intensity of auditory noise present varied proportionately to tracking error in four steps. Equal numbers of subjects trained for 1 or 3 weeks with either noisy or nonnoisy displays and under one of two degrees of auditory feedback specificity (magnitude of steps used to relate visual noise to error score). Subjects trained with visual noise showed better performance after 30 days despite the fact that subjects

trained with a noise-free display performed significantly better during training. The subjects trained for 3 weeks showed significantly better tracking performance on 30-day retention test than subjects who received only 1 week of training.
Author

N64-16813 Ohio State U., Columbus. Lab. of Aviation Psychology
LONG-TERM SKILL TRANSFER AND FEEDBACK CONDITIONS DURING TRAINING AND REHEARSAL Technical Report, Sep. 1962-Jul. 1963
James C. Naylor, George E. Briggs, and Robert Buckhout Wright-Patterson AFB, Ohio, Behavioral Sci. Lab., Dec. 1963 33 p refs
(Contract AF 33(657)-10081)
(AMRL-TDR-63-136; AD-431222) OTS: $0.75

Eight groups of subjects performed a continuous tracking and procedural task under various conditions of auditory performance feedback during training (8 days) and rehearsal (3 days). Four degrees of auditory cueing were used during training by varying (in size) the stepwise relationship between intensity of noise and amount of tracking error in three amounts plus a control condition of random noise. Two rehearsal conditions were used to complete the factorial arrangement—feedback similar to training versus random feedback. Rehearsal occurred 14 days after the completion of training, and a transfer test to the medium-noise condition was conducted 14 days following the last rehearsal session for all groups. Transfer performance was found to be significantly related to feedback specificity during training (medium specificity was inferior to either high or low specificity), whereas the rehearsal variable had no statistical effect on performance with any performance metric.
Author

15 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; sensors and transducers; and telescopes and cameras. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N64-16207 Bayerisch Akademie der Wissenschaften, Munich (W. Germany) Deutsche Geodatische Kommission
TELLUROMETRIC MEASUREMENTS OF DEPARTMENT ONE OF THE GERMAN GEODETIC RESEARCH INSTITUTE IN THE YEARS 1960 AND 1961. [TELLUROMETERMESSUNGEN DER I. ABTEILUNG DES DEUTSCHEN GEODATISCHEN FORSCHUNGSINSTITUTS IN DEN JAHREN 1960 UND 1961]
Rudolf Sigl and Gunther Zulsdorf 1963 49 p refs In GERMAN
(*Its* B-Angw. Geod.-94)

The results of the tellurometric measurements and of the adjustment of the distance networks for the geodetic reference frames at Meppin and Göttingen are presented in tabular form. Special emphasis is placed on calculating the refraction coefficient used in the slant range equation, and on the interpretation of the meteorological data. The tellurometer and and the development of a wavemeter for the tellurometer are discussed.
I.v.L.

N64-16210 Tokyo U. (Japan) Inst. of Industrial Science
THE MECHANISM OF PHOTOGRAPHIC DEVELOPMENT [LE MECANISME DU DEVELOPPEMENT PHOTOGRAPHIQUE]
Shinichi Kikuchi Dec. 1963 38 p refs in FRENCH
(*Its* Rept., v. 13, no. 4 (Serial 91))

Photographic development is chemically a reduction process that may be measured by the potential of the oxidation–reduction reaction. The common developers were measured by potentiometry, and the potentiometric value was compared with the sensitometric characteristics. The positive limit of the reduction potential for the silver halides, with and without exposure to light, was determined. The rotating electrode was introduced for the potentiometric measurement. The potentials of a developer measured by means of silver, gold, or platinum electrodes showed very little variation. The potential of an AgX system was measured. This method, wherein the behavior of the actual development in the AgX developer system was shown, appears to delineate the characteristics of development better than other methods. The reactions between $SO_3^{=}$, Ag^{+}, and hydroquinone were also studied by potentiometric means, and the dissociation constants of the complex silver sulfide salts were measured. The activation energy of the development was measured when an antifogging agent was added, and the difference in the reaction among these agents was interpreted by the difference in this energy.
Trans. by I.v.L.

N64-16236* Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.
METHODS FOR THE DYNAMIC CALIBRATION OF PRESSURE TRANSDUCERS
J. L. Schweppe, L. C. Eichberger, D. F. Muster, E. L. Michaels, and G. F. Paskusz Washington, NBS 12 Dec. 1963 115 p refs (Sponsored by NASA, Army, AF, and Bureau of Naval Weapons) (NBS Monograph 67) GPO: $0.60

CONTENTS:

1. INTRODUCTION [METHODS FOR THE DYNAMIC CALIBRATION OF PRESSURE TRANSDUCERS] J. L. Schweppe and L. C. Eichberger p 1–9 refs (See N64-16237 08-15)

2. ANALYTIC METHODS FOR LINEAR TRANSDUCERS L. C. Eichberger p 11–29 refs (See N64-16238 08-15)

3. APPROXIMATE METHODS OF LINEAR TRANSDUCER ANALYSIS L. C. Eichberger p 31–51 refs (See N64-16239 08-15)

4. ANALYSIS OF NONLINEAR TRANSDUCERS D. Muster p 53–67 refs (See N64-16240 08-15)

5. SIMPLE APERIODIC-FUNCTION GENERATORS J. L. Schweppe p 69–75 refs (See N64-16241 08-15)

6. SHOCK TUBE METHODS J. L. Schweppe p 77–86 refs (See N64-16242 08-10)

7. PERIODIC-FUNCTION GENERATORS D. F. Muster p 87–95 refs (See N64-16243 08-15)

8. THE ELECTRONIC COMPENSATOR E. L. Michaels and G. F. Paskusz p 97–104 refs (See N64-16244 08-09)

N64-16237* Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.
INTRODUCTION [Methods for the Dynamic Calibration of Pressure Transducers]
L. C. Eichberger and J. L. Schweppe *In its* Methods for the Dyn. Calibration of Pressure Transducers 12 Dec. 1963 p 1–9 refs (See N64-16236 08-15) GPO: $0.60

This article covers the mathematical models for transducers; the methods of analyzing pairs of input–output functions to determine the transfer function and the frequency response curve; the methods of generating precise input functions; and the specific methods for using precise experimental measurements to determine the dynamic characteristics of a pressure transducer. Specifically, this discussion introduces the types and characteristics of pressure transducers and the concepts of calibration and analysis. C.L.W.

N64-16238* Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.
ANALYTIC METHODS FOR LINEAR TRANSDUCERS
L. C. Eichberger *In its* Methods for the Dyn. Calibration of Pressure Transducers, 12 Dec. 1963 p 11–29 refs (See N64-16236 08-15) GPO: $0.60

The procedural steps of analytical analysis are introduced. These steps are applied to a linear transducer, which, for simplicity, is assumed to be a single-degree-of-freedom system. The characteristic differential equation of motion for this system is given. Response functions for the system are obtained for a given input function by both the classical and operational methods of analysis. The periodic (sine, square wave, and rectangular pulse) and aperiodic (rectangular pulse and step) functions are the input functions considered. Author

N64-16239* Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.
APPROXIMATE METHODS OF LINEAR TRANSDUCER ANALYSIS
L. C. Eichberger *In its* Methods for the Dyn. Calibration of Pressure Transducers, 12 Dec. 1963 p 31–51 refs (See N64-16236 08-15) GPO: $0.60

Various methods are discussed by which the response function of a transducer system can be expressed analytically as a function of time or transformed directly to the frequency domain. The major part of this analysis is based on the evaluation of a Fourier integral equation. To relieve the tedious and time consuming task of computing the integral and finding the solution in elementary situations, different approximations and/or computing aids are introduced to simplify the evaluation. Some of the approximations considered are harmonic analysis, staircase function, straight-line segment, trapezoidal, sin x/x, number series transformation, and the pseudorectangular pulse. The computing aids considered are Henderson's analyzer, Montgomery's optical Fourier analyzer, a photoelectric Fourier transformer, and an electronic analyzer with magnetic transient storage. C.L.W.

N64-16240* Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.
ANALYSIS OF NONLINEAR TRANSDUCERS
D. F. Muster *In its* Methods for the Dyn. Calibration of Pressure Transducers, 12 Dec. 1963 p 53–67 refs (See N64-16236 08-15) GPO: $0.60

The physical and analytical aspects of nonlinearity are discussed. The discussion focuses on the physical parameters of damping and stiffness and the manner of their representation in the analysis of transducer systems. Consideration is also given to analytical methods as they are applied to nonlinear systems. Particular attention is given to those methods and solutions of systems where the nonlinearity is confined to the restoring force term only and to those where it is confined to the damping term only. Among the methods of analysis, the describing-function method, the bilinear approximation, and the phase-plane method are discussed in detail. C.L.W.

N64-16241* Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.
SIMPLE APERIODIC-FUNCTION GENERATORS
J. L. Schweppe *In its* Methods for the Dyn. Calibration of Pressure Transducers, 12 Dec. 1963 p 69–75 refs (See N64-16236 08-15) GPO: $0.60

All methods of transducer calibration require that a known input be applied and that the output be measured precisely. Some methods of producing the required input and of evaluating the measured response are discussed. This paper covers three types of simple aperiodic-function generations: the dropping ball, the quick-opening device, and the explosive device. Author

N64-16243* Dresser Electronics, Houston, Tex. Southwestern Industrial Electronics Div.
PERIODIC-FUNCTION GENERATORS
D. F. Muster *In its* Methods for the Dyn. Calibration of Pressure Transducers, 12 Dec. 1963 p 87–95 refs (See N64-16236 08-15) GPO: $0.60

Primary concern is given to generators capable of producing pressure changes that closely approximate one of the waveforms of specific periodic functions of primary use in the dynamic calibration of pressure transducers. These waveforms are sinusoid, square-wave, and impulse functions. The generators include acoustical shock type, rotating valve and piston in-cylinder devices, sirens, and electrical, mechanical, and electromechanical exciters. C.L.W.

N64-16381 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTROMETEOROGRAPH FOR HELICOPTER (VEM)
V. P. Belyayev, N. K. Vinnichenko and L. A. Pakhomov 19 Jul. 1963 21 p refs Transl. into ENGLISH from book "Glavnoy Geofizicheskoy Observatorii IM A. I. Voyeykova" Leningrad Gidrometeorol. Izd., no. 135, 1962 p 135–146
(FTD-TT-63-632/1+2; AD-414990)

A description is presented of an electrometeorograph that was manufactured for use in a helicopter. This instrument is accurate in measuring a number of meteorological parameters, such as temperature, humidity, and air pressure, as well as helicopter overloads. R.T.K.

N64-16384 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ACCELERATION DATA TRANSMITTER
A. A. Leonov 24 Jul. 1963 4 p Transl. into ENGLISH from Russ. Pat. 152000 (Appl. 765749/26-10, 22 Feb. 1962) p 1–2
(FTD-TT-63-658/1; AD-415170)

A gravitational data transmitter, based on body graviopolarization phenomena, is described. The transmitter is made from insulation material in the form of a tube that is filled with an $AgNO_3$ solution (the graviopolarizing substance). Measurement of the EMF is conducted by silver measuring electrodes, passed through the closed ends of the tube. The purpose of this transmitter is to measure acceleration while obtaining a minimum zero drift, at high linearity, and directivity of transformation. I.v.L.

N64-16415 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BLACK AND WHITE NEGATIVE FILMS FOR AERIAL PHOTOGRAPHY SCOPE OF THE CONVENTION [FILMS NEGATIFS EN NOIR ET BLANC POUR PHOTOGRAPHIE AERIENNE]

15 Jun. 1963 9 p Transl. into ENGLISH from Stanag no. 3188 (1st Rev.), Serv. Tech. Aeron. 9 Dec. 61 p 1–7
(FTD-TT-63-108/1+2; AD-412943)

The aim of the conference was to standardize the classification of aerial films by their principal sensitometric and physical characteristics. The topics discussed include: (1) classification of aerial films; (2) the NATO method of determining the principal sensitometric and physical characteristics; and (3) preservation of film qualities. R.T.K.

N64-16420 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AUTOMATIC ELECTRONIC MULTIPOINT INSTRUMENT FOR CONTROLLING AND REGULATING TEMPERATURE
A. Kh. Udovichenko, G. I. Reshetov et al 22 Jun. 1963 6 p Transl. into ENGLISH from Rus. pat. no. 147044 (669289/26) 6 Jun. 1960, p 1–3
(FTD-TT-63-430/1+2; AD-412807)

The proposed automatic multipoint instrument is distinguished by the fact that, to assure the fixing of any given control temperature at each point, the indicating device of the instrument functions in accordance with an automatically equilibrating AC bridge, the arms of which contain variable resistors. The bridge makes an automatic comparison of the desired temperature values with the values fixed by the variable resistors. The principal arrangement of the automatic instrument is shown in a diagram. E.W.

N64-16428 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHOD OF MEASURING ACCELERATIONS
V. S. Klimov 24 Jul. 1963 4 p Transl. into ENGLISH from Russ. Pat. 152133, (Appl. 750402/26-10, 2 Nov. 1961) p 1–2
(FTD-TT-63-599/1+2; AD-415006)

A method is proposed for measuring all three components of the acceleration vector with the aid of one sensitive element. The device is a hollow sphere made of insulating material and is rigidly bound with radioactive radiation receivers. The inner surface of the sphere consists of two conductive layers between which a variable voltage is applied. In the center of the sphere is a radioactive sensitive element—a source of radioactive radiation and electric charge—which is held in suspended state by means of an electric field. The principal scheme of arrangement for the apparatus is indicated in a diagram. E.W.

N64-16482 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Division
DIFFERENTIAL BAROGRAPH WITH PHOTOGRAPHIC RECORDING OF THE READINGS
Yu. S. Dobrokhotov 28 Jun. 1963 18 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli, Akad. Nauk SSSR (Moscow), no. 24, 1962 116–123 p
(FTD-TT-63-535/1+2+4; AD-412823)

An instrument is described that is intended for continuous recording of changes in atmospheric pressure and is called a differential barograph. It is 10 to 12 times more sensitive than a mercury barometer. There are no metal springs in the instrument; therefore, its readings are free from the distorting effect of hysteresis and elastic deformation. R.T.K.

N64-16483 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE RATE OF DETECTING TEMPERATURE GRADIENT CHANGES BY MEASURING INSTRUMENTS
G. S. Gershenzon and K. N. Manuylov 2 Jul. 1963 5 p ref Transl. into ENGLISH from Tr. Nauchn. Issled. Inst. Gidrometeorol. Priborostr. (USSR), no. 10, 1961 p 99–100
(FTD-TT-63-540/1+2; AD-415007)

A discussion is presented of the ability of instruments, used in measuring temperature changes, to react to a change in the rate of heating or cooling of a medium. A table is included from which it is possible to determine the time interval for these instruments to detect a sudden change in the rate of heating of a given medium. R.T.K.

N64-16484 American Meteorological Society, Boston, Mass.
REPORT ON MEASUREMENT OF THE AIR TEMPERATURE WITH VARIOUS TYPES OF RADIATION SHIELDING [BEITRAG ZUR MESSUNG DER LUFTTEMPERATUR MIT VERSCHIEDENEN FORMEN DES STRAHLUNGSSCHUTZES]
Wilhelm Bauer and Richard Buschner Bedford, Mass., AFCRL [1963] 28 p refs Transl. into ENGLISH from Ber. Deu. Wetterdienst. (W. Germany), v. 3, no. 19, 1955 p 2–12
(Contract AF 19(604)-6113)
(T-G-193; AD-430609)

Three different designs of shelters and a shadow casing used as radiation shields are investigated. Their influence on the determination of air temperature with unventilated thermometers is studied. The thermal behavior of the different types of radiation shields is similar to the behavior of familiar thermometer housings, especially in specific adaptability. This property depends on the ratio of the heat capacity to the surface area of the thermometer housing. Therefore, the largest structures (such as a large and a medium-sized shelter) have the highest heat inertia, while the small shelter has a low heat inertia. If a simple casing of thin, highly reflective sheet aluminum is properly mounted as a radiation shield, no heat inertia can be detected. Because of the low time constant of standard thermometers, temperatures recorded inside the shadow casing can be employed without reduction. Author

N64-16495 Aerospace Corp., El Segundo, Calif.
MANNED MILITARY SPACECRAFT DISPLAYS
J. R. Buyan 31 Jan. 1964 40 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-303; TDR-269(4540-30)-1; AD-430563)

This report discusses the state-of-the-art of manned spacecraft display systems with emphasis on how future display developments will affect spaceborne computer requirements. The potential of both electroluminescent panels and cathode ray tubes as general purpose displays is discussed. Three-dimensional displays, predictor instruments, and a contact analog are evaluated as potential spaceborne displays. The display capabilities and philosophies of several companies are reported, and some of their significant display projects are described. Author

N64-16517 Joint Publications Research Service, Washington, D.C.
A HIGHLY SENSITIVE H-MAGNETOMETER
B. Ye. Bryunelli *In its* Recent Soviet Progr. in Magneto-Telluric Methods 6 Mar. 1964 p 27–32 refs (See N64-16513 08-12) OTS: $1.25

A highly sensitive H-magnetometer is described that employs electron-optical magnification and feedback. The continuous operation of the apparatus over a prolonged period at the Borok and Mirnyy observatories demonstrated its effectiveness under different environmental conditions and latitudes. R.T.K.

N64-16518 Joint Publications Research Service, Washington, D.C.
THE AMT-1 HIGHLY SENSITIVE H-MAGNETOMETER
V. P. Samoylenko *In its* Recent Soviet Progr. in Magneto-Telluric Methods 6 Mar. 1964 p 33–39 refs (See N64-16513 08-12) OTS: $1.25

The magnetometer described meets the following requirements: it records variations of the horizontal component with a period of 5 to 180 sec, possesses a high sensitivity, and has a resolution of 0.01γ in the range of variation amplitudes 0.3 to 10.0γ. R.T.K.

N64-16661 Colorado U., Boulder Lab. for Atmospheric and Space Physics
TRANSISTORIZED RADIOMETERS AND HIGH ALTITUDE RADIATION MEASUREMENTS Final Report, Jan. 1960–Dec. 1962
Robert Parker 15 Nov. 1963 93 p refs
(Contract AF 19(604)-7240)
(AFCRL-63-911; AD-429821)

This report describes three types of electronic-optic equipment packages for measurement of earth and solar radiation. One type is a miniature, electronic, bolometer-detector type with either optics-selector turret or optics spatial-scanner head. This type was designed to measure either the albedo of the earth or the self emission of the earth from a satellite. A second type, much bulkier than the first but functionally the same, was designed to measure the solar constant from an Aerobee rocket fitted with a biaxial pointing control. The performance in flight of the two instruments is discussed. The third type is an interferometric spectrometer, only one of which has been built. It was intended for use in a suborbital rocket flight study of the 6300A oxygen airglow spectral line to determine the intensity and Doppler width variation with altitude. Author

N64-16675* Princeton U. Observatory, N.J.
THE FIRST FLIGHT OF STRATOSCOPE II
Robert E. Danielson Repr. from Am. Scientist., v. 51, no. 4, Dec. 1963 p 375–399 refs
(Sponsored by NASA, NSF, and ONR; Proj. Stratoscope)

A description is presented of the stratoscope II telescope system and of the launching and operation procedures. During the first flight, Mars was scanned for approximately one-half hour. From the data obtained (only infrared emission was recorded), it appeared that the carbon dioxide abundance on Mars is about 6,000 cm-atm. The data also indicated a water-vapor content of 10μ in the Martian atmosphere. P.V.E.

N64-16771* Rice U., Houston, Tex.
CAPACITANCE EXTENSOMETERS FOR MICROSTRAIN MEASUREMENTS
D. E. Hartman, D. A. Bresie, and J. M. Roberts Repr. from Rev. Sci. Instr., v. 34, no. 11, Nov. 1963 p 1272–1273 refs
(NASA Grant NsG-6-59)

The Wayne Kerr capacitance bridge, which detects small capacitance changes, and a method for calibrating the instrument in about 3 minutes without disturbing the specimen are described. The Wayne Kerr bridge incorporates an internal parallel-plate capacitor attached to the micrometer head, which is balanced against the external gage. The W-K micrometer can be read to $\pm 5 \times 10^{-5}$ in., and for sensitive gap spacings ($d_{e1} \sim 0.010$ in.), where d_e is the plate separation in inches of the external plate, this represents an error of $\pm 0.5\%$. A_e/A_i, where A is the plate area in square inches and e and i refer to external and internal plates, respectively, is determined within $\pm 0.5\%$. With care, $\Delta\, d_i/\Delta V$ at d_{i2}, where d is the plate separation in inches and ΔV is the output of the bridge in volts, can be determined to $\pm 0.1\%$. Since the gage length is accurate to $\pm .01\%$ and the recorder error is $\pm 0.3\%$, the overall accuracy in strain calibration, with the described method, is $\pm$ 2.9%. Also, a capacitance gage, suitable for tensile tests of cylindrical specimens 1/2 in. or less in diameter, providing the specimen is sufficiently rigid to support the weight ($\sim$0.2 lb) of the gage, is described. I.v.L.

N64-16780 Brown (D.) Associates, Inc., Eau Gallie, Fla.
AN ADVANCED REDUCTION AND CALIBRATION FOR PHOTOGRAMMETRIC CAMERAS Final Report
Duane C. Brown 10 Jan. 1964 117 p refs Prepared for Instrument Corp. of Fla.
(Contract AF 19(604)-8493)
(AFCRL-64-40; AD-431886)

An advanced reduction must treat with full physical and statistical rigor such factors as: random errors in cataloged stellar positions; atmospheric refraction (particularly at great zenith distances); higher order symmetric radial distortion; tangential distortion and asymmetric radial distortion resulting from imperfectly centered optics; differential bias between measurements of different types of images; effective utilization of uncataloged stars for photogrammetric control; introduction of a priori constraints on any of the parameters of the reduction. Such a reduction is developed in this paper, and illustrations of its practical application are provided. Special attention is given to decentering distortion. The Advanced Plate Reduction is designed to be valid for any combination of focal length and angular field. By allowing for the possibility of correlated errors in the plate coordinates, it is also valid for cameras not having flat fields (e.g., the Baker–Nunn satellite camera). Author

N64-16796 Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
THE FERROUS-FERRIC DOSIMETER: A REVIEW
Edward A. Burke Dec. 1963 26 p refs
(AFCRL-63-587; AD-429156)

The characteristics, preparation, and use of the ferrous-ferric dosimeter are reviewed in detail. This includes a discussion of the dose range, dose rate dependence, energy dependence, and temperature effects. It is shown that for photons with energies in excess of 6 kev the irradiation yield may be represented by the expression $G = 15.61 - 15.43/E$, where E is the mean photon energy in kev and G is the number of ferrous ions oxidized per 100 ev of energy absorbed. Several methods of measuring ferric ion concentration are described, including the conventional spectrophotometric determination of ferric and ferrous ion and the very sensitive radiometric measurement of ferric ion. A concise summary of all the information necessary for routine application of this dosimeter is given. Author

16 LIFE SCIENCES

Includes biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness. *For related information see*: 14 Human Behavior; and 28 Space Radiation.

N64-16184* Stanford Research Inst., Menlo Park, Calif.
A TRANSDUCER FOR THE CONTINUOUS EXTERNAL MEASUREMENT OF ARTERIAL BLOOD PRESSURE
G. L. Pressman and P. M. Newgard *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 25 p refs (See N64-16151 08-08)
(NASA Contract NAS2-515)

It was necessary that the transducer provide a continuous measure of blood pressure, that it not encumber the subject, and that it not require cannulation. An indirect measurement of blood pressure based on arterial deflection was attempted first, but was unsuccessful. In the second approach attempted, arterial deflection was restrained by the transducer, and the resultant restraining force was measured. A mathematical model of the transducer–artery system was developed and was used as a guide for the design of the experimental prototype transducers. Tests performed on these experimental transducers gave results consistent with the predictions of the model.
Author

N64-16296 Joint Publications Research Service, Washington, D.C.
STUDIES ON RADIATION SICKNESS
I. B. Gurevich et al 9 Mar. 1964 32 p refs Transl. into ENGLISH from Med. Radiol. (Moscow), v. 9, no. 1, Jan. 1964 p 20–24, 49–52, 57–60, and 82–87
(JPRS-23566; OTS-64-21735) OTS: $1.00

CONTENTS:
1. ROENTGEN THERAPY IN THE ACUTE PERIOD OF BURN INJURY I. B. Gurevich and R. I. Murazyan p 1–8 refs
2. THE EFFECT OF Na_3Ca-DTPA (PENTACINE) ON Pu^{239} EXCRETION FROM THE HUMAN ORGANISM L. A. Plotnikova and G. D. Baysogolov p 9–13 refs
3. SOME BIOCHEMICAL INDICES WITH CHRONIC EXPOSURE OF EXPERIMENTAL ANIMALS TO LOW DOSES OF GAMMA-RADIATION S. A. Keyzer, K. V. Ivanov, N. M. Timofeyeva, and G. N. Il'yutkin p 14–20 refs
4. REVIEW OF A BOOK BY YE. F. ROMANTSEV: "CHEMICAL PROTECTION AGAINST RADIATION" A. A. Gorodetskiy and V. A. Barabay p 21–29

N64-16322* Naval Medical Research Inst., Bethesda, Md.
Quarterly Report Covering Period Oct.–Dec. 1963 [PHYSIOLOGICAL AND PSYCHOLOGICAL MECHANISMS WHICH DEFEND THE HUMAN BODY AGAINST HEAT AND COLD AND DETERMINE THE EXTENT AND EFFICIENCY OF ENERGY TRANSFORMATIONS IN THE HUMAN BODY AND IN ISOLATED BODY CONSTITUENTS AT THE MOLECULAR LEVEL]
T. H. Benzinger [1963] 13 p refs
(NASA Order R-38)
(NASA CR-55562) OTS: $1.60 ph, $0.80 mf

Descriptions are given for the mechanism of elementary biosynthesis that accounts for the consumption of molecular oxygen. Examples of the energy-transforming processes are taken from the microorganism *Nitrobacter winogradskyi*. The reactions that describe the thermodynamics of the biochemical systems are: (1) the oxidation and reduction of pyridine-nucleotide, DPN · H_2, with a nitrate system; (2) nitrate reduction in the absence of oxygen coupled with the oxidation of reduced pyridine-nucleotide; and (3) cell-respiration, which represents a combination of the two reaction branches of elementary biosynthesis. The process, cell respiration, is coupled with the mechanism of the elementary biosynthesis and the energy donor ATP, in conjunction with cytochrome oxidations.
A.B.

N64-16324* California U., Los Angeles Brain Research Inst.
CORTICAL-SUBCORTICAL RELATIONSHIPS OF THE CHIMPANZEE DURING DIFFERENT PHASES OF SLEEP
J. M. Rhodes, M. R. Reite, Dan Brown, and W. R. Adey [1963] 23 p refs
(NASA Grant NsG-203-62; NASA Grant NsG-502; AF AFOSR Grant 246-63)
(NASA CR-55689) OTS: $2.60 ph, $0.89 mf

The cortical–subcortical relationships of the chimpanzee during different phases of sleep were investigated by various methods. Results indicate that: (1) The chimpanzee has an EEG similar to that of man. (2) There is considerable variability during the initial stages of sleep, with the cortex and subcortex showing varying electrical patterns until at least a medium (or spindle) stage of sleep is achieved. (3) The hippocampal–neocortical rhythms are not inversely related, as is the case in cats. (4) There may well be several stages of paradoxical sleep, with the rhinencephalon having a particularly important role.
I.v.L.

N64-16325* School of Aerospace Medicine, Brooks AFB, Tex.
ECOLOGIC RELATIONSHIPS BETWEEN BACTERIA AND ALGAE IN PHOTOSYNTHETIC GAS EXCHANGERS Quarterly Status Report No. 1, 1 Aug. 1963–31 Oct. 1963
[1963] 7 p
(NASA Order R-99)
(NASA CR-55423) OTS: $1.10 ph, $0.80 mf

Summaries are presented of the following experiments: (1) isolation and identification of bacteria from algal cultures, (2) bacterial viable cell count—dry weight determinations, and (3) effect of bacterial isolates on the growth of *Chlorella pyrenoidosa*.
R.T.K.

N64-16326* Pennsylvania State U., University Park
PILOT THEORETICAL STUDY OF THE EFFECT OF WEIGHTLESSNESS AND DENSELY IONIZING RADIATION ON SINGLE CELLS Final Report
Ernest C. Pollard, Warren Yiesley, Thomas Barone, and John Weare 14 Jan. 1964 16 p
(NASA Grant NsG-182-62)
(NASA CR-55656) OTS: $1.60 ph, $0.80 mf

An investigation was made of the relationship between the behavior of a living cell and the mechanical stress set up by intermolecular forces in response to the distortion produced by gravity. Of particular concern is whether the absence of gravity will affect the behavior of a cell of a living system. Theoretical inquiry is made to uncover predictions suggesting an answer to this question.
C.L.W.

N64-16327* New Mexico State U., University Park
NEW MEXICO STATE UNIVERSITY OBSERVATORY
Clyde W. Tombaugh and Bradford A. Smith Repr. from Astron. J., v. 68, no. 9, Nov. 1963 p 666–667
(NASA Grant NsG-142-61)

A new Gregorian mirror, giving an equivalent focal length of 45 feet to a 16-inch telescope, was completed, and a complete photographic darkroom for the reproduction and printing of planetary photographs was established. Photographic observations were made of Mars, Venus, Jupiter, Saturn, and of the rapidly moving asteroid, Betulia. Visual observations were made of Mars and Jupiter.
C.L.W.

N64-16328* Washington U., St. Louis, Mo. Medical School
HISTOLOGICAL STUDIES ON THE INNER EARS OF SELECTED MONKEYS Final Report, Sep. 1, 1961-Dec. 31, 1963
Catherine A. Smith [1963] 6 p
(NASA Grant NsG-267-62)
(NASA CR-55517) OTS: $1.10 ph, $0.80 mf

The ears from eight squirrel monkeys treated with streptomycin sulfate, and from three normal monkeys were perfused, fixed, embedded in celloiden, cut, and stained. All the streptomycin-treated animals showed either pathology or hair cell loss in the cristae of the semicircular canals. The otolithic organs were either normal in appearance or showed minor changes. The organs of Corti showed changes ranging from outer hair cell loss to complete degeneration, limited primarily to the first turn of the cochlea. Author

N64-16353 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BIOLOGY AND FLIGHTS INTO THE COSMOS: FURTHER SEARCH OF SCIENCE
N. N. Zhukov-Verezhnikov (Acad. Med. Sci. USSR) and V. Ya. Kopyev *In its* Sci. and Life (Selected Articles) 10 Dec. 1962 p 19–30 (See N64-16351 08-01)

This report presents discussions of the following: (1) the chemical and physical effects on cells that might result from flying to closer lying planets; (2) planetary organisms and how to prevent their penetration to earth; (3) the biological conditions of long-distance flights at near-light velocities; and (4) the possibility of biologically testing the Theory of Relativity. I.v.L.

N64-16377 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PLUTONIUM-239: ITS DISTRIBUTION, BIOLOGICAL EFFECT AND ACCELERATED ELIMINATION
Yu. A. Belyayev et al 27 Nov. 1963 278 p refs Transl. into ENGLISH from the publ. "Plutoniy-239 Raspredeleniye, Biologicheskoye Deystviye, Uskoreniye Vyvedeniya" Moscow, Medgiz, 1962 p 1–168
(FTD-TT-63-559/1+2; AD-430440)

CONTENTS:

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2. DISTRIBUTION AND EXCRETION OF PLUTONIUM IN DOGS AT LONG INTERVALS FOLLOWING ADMINISTRATION T. N. Rysina and R. A. Yerokhin p 8–18
3. TOXICOLOGIC PROPERTIES OF SODIUM PLUTONYL TRIACETATE AND ITS DISTRIBUTION IN THE RAT BODY Yu. A. Belyayev, N. I. Yelkina, V. V. Konstantinova, and I. A. Tseveleva p 19–24
4. MICRODISTRIBUTION OF PLUTONIUM IN RABBIT AND RAT LIVER V. K. Lemberg and A. P. Nifatov p 25–38
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11. CONTENT AND REGENERATION OF NUCLEIC ACIDS IN RAT LIVER FOLLOWING PLUTONIUM INJURY V. V. Konstantinova p 92–103
12. EFFECT OF PLUTONIUM ON NUCLEIC ACID METABOLISM IN THE LIVER AND BONE MARROW OF THE RABBIT R. Ye. Libinzon and V. V. Konstantinova p 104–112
13. ACTIVITY OF TISSUE PHOSPHATASES IN RATS SUFFERING FROM SUBACUTE OR CHRONIC PLUTONIUM INJURY R. E. Libinzon and V. V. Konstantinova p 113–121
14. EFFECT OF PLUTONIUM-239 ON RAT BODY Yu. I. Moskalev, L. A. Buldakov, and V. N. Strel'tsova p 122–132
15. CHANGES IN THE BLOOD SYSTEM OF RABBIT EFFECTED BY PLUTONIUM-239 V. K. Lemberg, N. A. Kushurnikova, and K. N. Klyzhuk p 133–149
16. PECULIARITIES IN THE COURSE AND OUTCOME OF RADIATION SICKNESS IN DOGS INJECTED INTRAVENOUSLY WITH THE NITRATE OF PLUTONIUM-239 L. V. Bogatov, Z. I. Kalmykova, N. P. Kudasheva, and S. A. Rogacheva p 150–172
17. PATHOLOGICAL ANATOMY OF AFFECTION WITH PLUTONIUM-239 V. N. Streltsova p. 173–193
18. MORPHOLOGICAL CHANGES IN RABBIT AND DOG LIVER INDUCED BY PLUTONIUM-239 A. P. Nifatov p 194–214
19. DYNAMIC CHANGES OF BONE TISSUE IN RABBITS POISONED WITH PLUTONIUM-239 Z. M. Bukhtoyarova p 215–229
20. EFFECT OF ION EXCHANGE RESINS AND COMPLEXONS PLUTONIUM DISTRIBUTION IN THE GASTROINTESTINAL TRACT Yu. A. Belyayev p 230–236
21. EFFECT OF SOME COMPLEXONS ON PLUTONIUM REMOVAL IN RATS Yu. A. Belyayev p 237–245

N64-16379 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
IN THE AIR HOVERS A CAT (WEIGHTLESSNESS EXPERIMENTS)
L. Kitayev-Smyk 11 Jun. 1963 9 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 4, 1963 p 35–39
(FTD-TT-63-618/1; AD-412822)

A series of experiments were conducted with various types of animals to show their behavior characteristics during weightlessness and their ability to adapt. Tested were fish, pigeons, rabbits, guinea pigs, white mice, rats, cats, and dogs. The initial reactions to the period of weightlessness are recorded along with the attempts of the animals to stabilize themselves and their final acceptance of the state. C.L.W.

N64-16383 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MEMOIR ON THE EXTRAORDINARY DEGREES OF HEAT WHICH MAN AND ANIMALS ARE CAPABLE OF RESISTING
M. Tillet 5 Jul. 1963 25 p refs Transl. into ENGLISH from the book "Memoires de l'Academie Royale" 1764 p 186–205
(FTD-TT-63-650/ 1+4; AD-413585)

This report discusses experiments that appear to establish the following facts: (1) Man can resist, for a certain length of time, a heat that will appear excessive without showing any signs of indisposition. (2) Various animals can withstand a much greater heat than that which Boërhaave mentions, and suffer no untoward accident. Experiments are also cited that indicate that man can, without any risk and with perhaps marked success in the case of the curing of certain illnesses (e.g., dropsy), be exposed for a short time to violent heat. I.v.L.

N64-16396 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE ROLE OF BACTERIA IN THE CONVERSION OF THE CARBON PORTION AND OF THE ASPHALT RESIN COMPONENTS OF PARAFFIN-BASE PETROLEUM UNDER ANAEROBIC CONDITIONS

T. L. Simakova, N. V. Strigaleva et al 6 Feb. 1963 40 p refs Transl. into ENGLISH from Geokhim. Sb. (Moscow), no. 7 1961 p 77–97

(FTD-TT-62-1449/1+2+4; AD-298651)

Investigations were conducted to study the influence of microflora on the conversion of several components of petroleum under anaerobic conditions. Both hydrocarbon and heterogeneous substances were tested. During the experiments, the dynamics of the quantity of bacteria and the pH value were studied. On ending the experiment, the pure bacteria cultures were separated, and their physiological properties and culture characteristics were studied. The changes that took place in the hydrocarbon fractions, oils, and hydrocarbons were studied by physiochemical and optical means. The elemental composition was determined in resins and asphaltenes, and the gas formed in several experiments was analyzed. C.L.W.

N64-16418 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MOTION SICKNESS: PROPHYLAXIS AND TREATMENT

Docent G. Komendantov and V. Kopanev 2 Apr. 1963 6 p Transl. into ENGLISH from Med. Gazeta (USSR), 5 Dec. 1962 p 3

(FTD-TT-63-287/1+4; AD-402444)

Motion sickness is controlled by technical improvement of transportation facilities, the establishment of an optimal microclimatic environment for passengers, and the special selection and training of transportation workers. Conditioning of the vestibular system is the best preventative for all forms of motion sickness. Many drugs have been proposed for the prevention and cure of motion sickness. These are, for the most part, drugs that lower the parasympathetic tone of the central nervous system. This group includes atropine, scopolamine, aeron, and others. Use of these drugs has proved effective in 40% to 80% of the cases observed. Drugs that lower the excitability of the central nervous system work well. These are soporifics, antihistamines, and compounds of the aminazine group. Barbital sodium gave positive results in 70% of the cases observed. Compounds from among the nervous-system stimulants, which increase the nonspecific resistance of the organism, are effectively used. Among these are vitamin B_6 and dibazol. A mixture of 0.005g of platyphylline, 0.1g of caffeine, 0.15g of potassium bromide, 0.03g of papaverine, and 0.005g of phenamine, and the triple composition of 0.2g of caffeine and 0.05g of diphasine and of dimerdrol are effective when taken 30 to 60 minutes before subjection to rolling. I.v.L.

N64-16541 Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Research Inst.

MECHANISMS OF ACTION OF THE INSECTICIDE ENDRIN

Thomas E. Emerson, Jr., Charles M. Brake, and Lerner B. Hinshaw Aug. 1963 17 p refs

(CARI-63-16)

Cardiovascular effects of endrin insecticide are obscure. Experiments to investigate these phenomena were carried out on dogs, and suggested mechanisms of action have been proposed. Results show that acute administration of endrin produces bradycaria, hypertension, copious salivation, hyperexcitability, tonic-clonic convulsions, increased body temperature, leukocytosis, hemoconcentration, and decreased blood pH. Cerebral venous pressure and cerebrospinal fluid pressure elevations are also prominent features of endrin poisoning. Although most of these effects appear to be caused by endrin acting directly on the central nervous system, some may result secondarily from altered cerebral hemodynamics. Author

N64-16543 Joint Publications Research Service, Washington, D.C.

ANTI-RADIATION AND ANTI-OXIDATION PROPERTIES OF CERTAIN POLYPHENOLS

V. A. Baraboli and B. Ya. Medovar 9 Mar. 1964 11 p refs Transl. into ENGLISH of an article from Ukr. Biokhim. Zh. (Kiev), v. 35, no. 6, 1963 p 924–929

(JPRS-23567; OTS-64-21736) OTS: $0.50

Polyphenol structures, such as gallascorbin, tannin, extract of eglantine, rutin, and other gallates, have both a protective and a therapeutic antiradiation effect. The compounds of this group also have a definite antioxidation property, because they retard the production of peroxides in the irradiation of oleic acid. Therefore, it is concluded that the antiradiation action of these polyphenols is associated not only with the P-vitamin activity but also with their antioxidation capacity. The existence of a direct dependence between the antioxidation and antiradiation properties of the investigated polyphenols has been established. E.W.

N64-16544 Joint Publications Research Service, Washington, D.C.

CHANGE IN THE RATIOS BETWEEN THE EXCRETION OF 17-HYDROXYCORTICOSTEROIDS AND 5-HYDROXYINDOLEACETIC ACID IN PILOTS

I. V. Fedorov, I. M. Khazen, and G. G. Sturua 10 Mar. 1964 10 p refs Transl. into ENGLISH of an article from Voprosy Med. Khim. (Moscow), v. 9, no. 6, 1963 p 583–587

(JPRS-23607; OTS-64-21756) OTS: $0.50

Investigated are the relations between urine excretions of 17-hydroxycorticosteroids and the product of the exchange of serotonine (5-hydroxyindoleacetic acid) of pilots in training for complex group flights. Inasmuch as the emotional stress is frequently accompanied by a sharp increase in the frequency of respiration and heart contractions (double or more), which can establish a hypocapnic state, the acidity, bicarbonates, ammonia, phosphorous, and creatinine in the urine were determined. Author

N64-16545 Joint Publications Research Service, Washington, D.C.

BIOLOGICALLY ACTIVE POLYVINYL ALCOHOL LETILAN FIBERS

L. A. Volf 10 Mar. 1964 9 p refs Transl. into ENGLISH of an article from Khim. Volokna (Leningrad), no. 6, 1963 p 16–18

(JPRS-23609; OTS-64-21757) OTS: $0.50

Fibers possessing antibacterial action can be used as is for surgical thread or can be made into bandages, gauze, adhesive tapes, etc. The fibers were treated with the preparations letilan-1 and letilan-2, and these samples were subjected to bacteriological investigation. Their relation to bacteria such as staphylococci, intestinal bacilli, Proteus, and streptococci was studied. Results showed that 1 g of fiber completely suppressed the growth of bacteria in a volume of meat broth to two liters, and the zone of growth inhibition due to 1 g of fiber on a solid medium was 18 mm for staphylococcus and 16 mm for intestinal bacillus. A study of the influence of multiple washings on the biological activity of the fiber was also made. Samples were subjected to 10 boilings and still retained their bactericidal properties. Letilan-1 and letilan-2 treated fibers also act as fungicides. E.W.

N64-16551 Tennessee U., Oak Ridge Agricultural Research Lab.
Semi-Annual Progress Report, Jan. 1-Jun. 30, 1963 [RESEARCH ACTIVITIES]
Washington, AEC Div. of Tech. Inform. Jan. 1964 122 p refs
(Contract AT-40-1-GEN-242)
(ORO-614) OTS: $2.50

Research activities in the following areas are discussed: (1) clinical medicine in radiation studies; (2) the physiology of reproduction; (3) radiation pathology; (4) the physiological effects of radiation; (5) fission-product metabolism in beef cattle, dairy cattle, sheep, swine, and poultry; (6) the fission-product chemistry of soils; (7) the biochemistry of fission-product elements; and (8) radiation genetics. Also, a veterinarian's report on herd health, surgery, and the development of techniques for embryonic surgery is presented. I.v.L.

N64-16554 Georgia U., Athens School of Forestry
THE POPULATION STATUS OF THE LARGER VERTEBRATES ON THE ATOMIC ENERGY COMMISSION SAVANNAH RIVER PLANT SITE Final Report
James H. Jenkins and Ernest E. Provost Washington, AEC Div. of Tech. Inform., 15 Feb. 1964 51 p refs
(Contract AT(38-1)-224)
(TID-19562) OTS: $1.25

A survey of types of animals (mainly game and feral species) found on the plant site is summarized. P.V.E.

N64-16567 Naval School of Aviation Medicine, Pensacola, Fla.
AN INSTRUMENT FOR VCG AND SCALAR ECG MEASUREMENTS Research Report No. 2
W. Carroll Hixson and Newton W. Allebach 26 Mar. 1963 20 p refs
(AD-412814)

An instrument was developed that displays the instantaneous electrical activity of the heart in either VCG loop form or in conventional scalar time-magnitude form with direction held constant. For the scalar representation, the instrument allows the electrophysical forces of the heart in any one of twelve equally spaced axes of the three orthogonal body reference planes to be displayed on a conventional time-amplitude ECG recorder. In addition, the instrument, utilizing commercially available preamplifiers that are compatible with other research equipments in use by this activity, permits the X, Y, and Z scalar signals derived from the Frank or similar VCG lead systems to be simultaneously displayed on a high-frequency galvanometer recorder or stored for later computer analyses on a magnetic tape instrumentation recorder. Author

N64-16573 Los Alamos Scientific Lab., N. Mex.
BIOLOGICAL AND MEDICAL RESEARCH GROUP (H-4) OF THE HEALTH DIVISION Annual Report, Jul. 1962-Jun. 1963
W. H. Langham and T. L. Shipman 14 Feb. 1964 376 p refs
(Contract W-7405-ENG-48)
(LAMS-3034) OTS: $4.50

Reorientation of the biomedical research program toward molecular- and cellular-level studies continued at an accelerated rate, and activities conducted in the following areas are discussed: (1) mammalian metabolism; (2) mammalian radiobiology; (3) low-level radioactivity counting; (4) clinical investigations of cellular volumes; (5) cellular radiobiology; and (6) molecular radiobiology. I.v.L.

N64-16574 Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Research Inst.
THE MECHANISMS OF INTRARENAL HEMODYNAMIC CHANGES FOLLOWING ACUTE ARTERIAL OCCLUSION
Lerner B. Hinshaw, Barbara B. Page, Charles M. Brake, Thomas E. Emerson, Jr., and Frederick D. Masucci Oct. 1963 27 p refs
(CARI-63-22)

The purpose of the present study was to determine intrarenal hemodynamic changes in intact and isolated kidneys following arterial occlusion. The relative roles of metabolic, myogenic, and tissue pressure influences on the postocclusion response were evaluated. Increases in renal resistance appeared to be due in part to adrenergic agents and were enhanced by extending time of occlusion and lowering the arterial pressure. The combined effects of prevenous dilatation and diminished tissue pressure resulted in a decreased resistance following shorter periods of occlusion. Prevenous dilatation was accounted for by depressed vascular sensitivity to pressor agents and the presence of vasodilator substances. Changes in venous segment resistance were found to be of primary importance in both the autoregulatory phenomenon and the postocclusion hyperemic response to short (15 sec) occlusion periods. Author

N64-16584 Oregon State U., Corvallis Sciences Research Inst.
BIOCHEMICAL AND PHARMACOLOGICAL STUDIES OF 1, 1-DIMETHYLHYDRAZINE
R. S. Mc Cutcheon, R. D. Barbour and C. H. Wang Wright-Patterson AFB, Ohio, Biomedical Lab., Dec. 1963 22 p refs
(Contract DA18-108-CML-7154; Proj. TORES)
(AMRL-TDR-63-127; AD-431216) OTS: $0.75

UDMH at doses of 20, 40, and 60 mg/kg was rapidly metabolized by the rat as evidenced by the metabolism of UDMH-C^{14} methyl groups to respiratory $C^{14}O_2$. C^{14} was also rapidly excreted into the urine after administration of UDMH-C^{14} to the rat. At low levels of UDMH intoxication, the bulk of the compound was either metabolized to respiratory $C^{14}O_2$ or excreted as either UDMH or a metabolite(s) in 4 to 6 hr after administration. Total respiratory CO_2 production by rats was only slightly inhibited during a 16-hr period after intraperitoneal administration of 40 mg/kg of UDMH. UDMH intoxication of rats at doses of 20, 40, and 60 mg/kg appeared to preferentially inhibit glucose catabolism to respiratory CO_2 via glycolysis and the pentose phosphate pathway. A C-6 decarboxylation process, such as the glucuronate pathway, appeared to be unaffected by UDMH intoxication. Author

N64-16585 Oregon State U., Corvallis Science Research Inst.
LETHALITY OF PENTABORANE-9 IN MAMMALIAN ANIMALS Technical Documentary Report, 1 Jun. 1962-31 May 1963
F. N. Dost, D. J. Reed, and C. H. Wang Wright-Patterson AFB, Ohio, Biomed. Lab., Dec. 1963 17 p refs
(Contract DA-18-108-CML-7154)
(AMRL-TDR-63-128; AD-431218) OTS: $0.50

A method of transfer and administration of pentaborane-9 to small animals was described. By use of this procedure, median lethal doses of pentaborane-9 by intraperitoneal and inhalation administration to the rat were determined to be 3.7 mg/kg and 0.42 mg/kg, respectively. An intravenous median lethal dose to the rabbit of 0.52 mg/kg was estimated. Author

N64-16641 Baylor U., Houston, Tex. Bioelectronics Lab.
AUTOMATIC GSR ANALYZER
Neil R. Burch, Harold E. Childers, and Robert J. Edwards, Jr. Brooks AFB, Tex., School of Aerospace Med., Nov. 1963 36 p refs
(Contract AF 41(609)-1527)
(SAM-TDR-63-74; AD-430921) OTS: $3.60

To extend the studies of GSR activity, an automatic analyzer was designed, and a prototype system was built and tested. The analyzer measures the sum of onset-to-peak amplitudes, the sum of the onset-to-peak times, and the number of GSR's per epoch. The analyzer reduces the data at a rate equal to generation of the GSR activity, and it is expected that analysis that is faster than real-time analysis can be accomplished with a tape recording system and some modification of the analyzer. With the automatic analyzer, studies can be carried out with immediate data reduction, which should aid in defining the relations between the parameters of GSR activity and the level of arousal in psychophysiologic studies. Author

N64-16642 R. F. Communications, Inc., Rochester, N.Y.
DEVELOPMENT OF A MINIATURE TELEMETRY SYSTEM
David A. Kavanagh Brooks AFB, Tex., School of Aerospace Med., Nov. 1963 16 p refs
(Contract AF 41(657)-419)
(SAM-TDR-63-80; AD-431726) OTS: $1.60

Experiments with VHF miniature transmitters submerged in physiologic saline solution to simulate their being implanted in living animals indicate that internal telemetry from small animals may be feasible at frequencies as high as 200 mc. Further study is needed before conclusions can be drawn relative to the frequency range best suited for large animals. Tests with transmitters below 20 mc held under a person's armpit indicate that the human body is essentially transparent to internal telemetry signals in that frequency range. Modulation schemes, power supplies, and encapsulants are discussed. Author

N64-16643 Northrop Corp., Hawthorne, Calif. Space Labs.
EVALUATION OF CERTAIN MARINE ALGAL FLAGELLATES FOR MASS CULTURE
Richard W. Eppley Brooks AFB, Tex., School of Aerospace Med., Nov. 1963 15 p refs
(Contract AF 41(609)-1608)
(SAM-TDR-63-91; AD-431726) OTS: $1.60

Environmental requirements are reported for maximum growth of 10 strains of marine flagellates of the group Volvocales. Three strains display growth rates above average for green algae: *Dunaliella tertiolecta, D. primolecta, and Tetraselmis tetrathele*. The algae examined display a spectrum of salinity optima, allowing selection of a strain suitable for mass culture in water of any available salt content. The optimum temperature for growth is found to vary with the salt concentration of the growth medium for *D. tertiolecta*. All strains examined so far are unusually tolerant of urea, although not all can use urea as a source of nitrogen for growth. First attempts to obtain mutants capable of utilizing bright light were unsuccessful but provided data on pigment composition and photosynthetic rates of algal cells adapted to growth in light about 1.5 times as intense as sunlight. Author

N64-16645 Chicago U., Ill. USAF Radiation Lab.
Quarterly Progress Report No. 50 [RESEARCH ON CERTAIN BIOLOGICAL AND MEDICAL ASPECTS OF ATOMIC ENERGY]
Kenneth P. Du Bois 15 Jan. 1964 133p refs
(Contract AF 41(609)-1693)
(AD-430559)

The following research studies are summarized: (1) the effects of ionizing radiations on the biochemistry of mammalian tissues—influence of X-irradiation on the development of a thiophosphate-oxidizing enzyme system in the livers of male rats, influence of various factors on radiation-induced inhibition of the development of detoxification enzymes, and studies on the toxicity and mechanism of action of 2-mercaptoethylamine; (2) pharmacological and toxicological compounds as protective or therapeutic agents against radiation injury in experimental animals—the influence of various chemical compounds on radiation lethality in mice, therapy of radiation injury in mice with chemical agents, histopathological findings in the tissues of X-rayed mice treated with combinations of homologous bone marrow and 2-iminothiazolidine-4-carboxylic acid, and comparison and analysis of protective effectiveness of AET derivatives; and (3) the influence of exposure to low levels of gamma and fast-neutron irradiation on the life span of animals—current status of the chronic low-level fast-neutron irradiation program, and time independence of dose reduction factors in proton or X-ray irradiated mice pretreated with MEA or PAPP. P.V.E.

N64-16668 Joint Publications Research Service, Washington, D.C.
CURRENT METHODS OF ELECTROENCEPHALOGRAPHIC ANALYSIS
V. A. Kozhevnikov and R. M. Meshcherskiy 10 Mar. 1964 281 p refs Transl. into ENGLISH of the book "Sovremennyye Metody Analiza Elektroentsefalogrammy" Moscow, 1963 p 1-328
(JPRS-23590; OTS-64-21749) OTS: $4.00

The application of various methods of electroencephalographic analysis to clinical research and in experimental neurophysiology is discussed. Both the simplest (visual analysis, application of the method of quantitative estimation of the cerebral potentials) and more complicated methods of automatic analysis (registration of envelopes, measurement of the total bioelectrical activity, frequency and correlation analysis, and methods of coherent reception) are analyzed. The necessary criteria are presented for the interpretation of artifacts of various kinds in the electroencephalogram. Special attention has been given to the utilization of the probability method in electroencephalography for the detection of weak cerebral reactions and to the prospects of using computers. Author

N64-16674 National Academy of Sciences–National Research Council, Washington, D.C. Committee on Hearing, Bioacoustics, and Biomechanics
CHABA– 1963. ANNUAL REPORT OF THE NATIONAL ACADEMY OF SCIENCES–NATIONAL RESEARCH COUNCIL COMMITTEE ON HEARING, BIOACOUSTICS, AND BIOMECHANICS, JANUARY-DECEMBER, 1963
Milton A. Whitcomb Feb. 1964 25 p refs

A summary of the activities at the meeting is given, along with abstracts of papers that were presented. Papers presented at the Symposium included the following: Operational Vibration Environments in Spacecraft, Vibration Environment During Flight at Low Altitude, Human Tolerance Limits to Extreme Vibrational Stress, Tissue Strength and Organ Displacement, Organ Displacements Studied with X-ray Cinematography, Effects of Vibration on Operator Performance, Effects of Vibration on Speech, Pilot Performance in Buffeting Environment, and The Effect of Combined Sustained Accelerations and Vibrations. A summary of CHABA working group meetings is also presented. P.V.E.

N64-16691 Clymer (A. Ben), Columbus, Ohio
TRENDS IN THE DEVELOPMENT AND APPLICATIONS OF ANALOG SIMULATIONS IN BIO-MEDICAL SYSTEMS
A. Ben Clymer and G. F. Graber (Applied Dyn., Inc.) [1963] 36 p refs
(Partially supported by Electronics Associates, Inc.)

Biosystem model identification and biosystem simulation are discussed. Identification of a mathematical model is the determination of any unknown parameters or functions in it, using experimental data as a basis. A biosystem simulation is distinguished arbitrarily from a biosystem mathematical model by requiring that a simulation be a physical embodiment of a mathematical model. However, this distinction is a matter of degree. The accomplishments in biosystem model identification and the possible uses, purposes, and benefits of and accomplishments in biosimulation are discussed. Predictions concerning future simulation developments are made. It is believed that within 5 years approximately 1,000 papers will be published per year in the areas of biosystem model identification and simulation. I.v.L.

N64-16694 Joint Publications Research Service, Washington, D.C.
FOUR EXPERIMENTAL STUDIES ON RADIATION SICKNESS THERAPY
13 Mar. 1964 38 p refs Transl. into ENGLISH of 4 articles from Med. Radiol. (Moscow), v. 8, no. 12, 1963 p 31–37, and 50–59
(JPRS-23678; OTS-64-21691) OTS: $1.00

CONTENTS:

1. EFFECTIVENESS OF EARLY USE OF ARTIFICIAL KIDNEY IN DOGS RECEIVING LETHAL DOSES OF STRONTIUM-90 M. G. Petrovnin p 1–11 refs

2. THE EFFECT OF COMPLEX-FORMING AGENTS ON THE MAGNITUDE OF RENAL TISSUE RADIATION DOSAGE WITH ADMINISTRATION OF RADIOACTIVE SUBSTANCES L. A. Il'in, T. A. Norets, G. V. Arkhangel'skaya, and E. I. Shcherban' (RSFSR Min. of Public Health) p 12–19 refs

3. EXPERIMENTAL DATA ON INCREASED RESISTANCE TO RADIATION SICKNESS AFTER PRELIMINARY ADMINISTRATION OF TETRACYCLINES TO RATS A. M. Dumova and O. O. Chirkova (Leningrad Sci. Res. Inst. of Antibiotics) p 20–28 refs

4. INVESTIGATION OF THE POSSIBILITY OF OBTAINING IMMUNE SERA TO ALLEVIATE THE COURSE OF RADIATION SICKNESS IN EXPERIMENTAL ANIMALS V. I. Fofanov and A. T. Kravchenko p 29–35 refs

N64-16745* IIT Research Inst., Chicago, Ill.
LIFE IN EXTRATERRESTRIAL ENVIRONMENTS Quarterly Status Report, 15 Nov. 1963–15 Feb. 1964
Charles A. Hagen and Regnel Jones [1964] 16 p refs
(NASA Contract NASr-22, IITRI Proj. C 194)
(NASA CR-53106; IITRI C194-12) OTS: $1.60 ph, $0.80 mf

Incorporation of 4.9% or 21.7% moisture into the dry simulated Martian soil modified by the addition of 1% organic medium increased the number of *B. subtilis* surviving the inoculating and flushing procedures. Lower moisture concentrations, 2.0% and 0.25%, did not have this effect. However, the death rate was greater in the tubes with 4.9 and 21.7% moisture. Thus, after 56 days of exposure there was no significant difference between the groups. Less than 0.02% of *Ps. aeruginosa* cells survived a 1-week exposure to Martian environment modified by 10% organic medium and 10% moisture. *B. cereus* spores survived the simulated Martian environment modified by 10% organic medium plus 20% moisture, but there was no apparent germination. Author

N64-16806 Mayo Clinic, Rochester, Minn. Mayo Foundation
DECREASES IN ARTERIAL OXYGEN SATURATION AS AN INDICATOR OF THE STRESS IMPOSED ON THE CARDIORESPIRATORY SYSTEM BY FORWARD ACCELERATION ($+G_x$) Technical Report, 23 Aug. 1960–1 Mar. 1961
Earl H. Wood, A. Clark Nolan, Hiram W. Marshall, Lucille Cronin, and William F. Sutterer Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs. (6570th), Dec. 1963 42 p refs
(Contract AF 33(616)-7594)
(AMRL-TDR-63-104; AD-431631) OTS: $1.25

The cardiorespiratory alterations produced by $+G_x$ on a human centrifuge were studied to determine their temporal characteristics. Blood oxygen saturation was recorded by ear oximetry, and by cuvette oximetry in blood withdrawn continuously from the radial artery of eight subjects during 3 to 4 minutes at 2.2, 3.7, 5.6, and on two occasions at 6.4 $+G_x$. Observations were made when air and 99.6% oxygen were breathed by three subjects during intermittent positive pressure (air, 33 mm Hg) breathing. Thoracic roentgenograms were obtained before and 30 to 60 seconds and 5 minutes after 5.6 and 6.4 $+G_x$. In five subjects, pressures were recorded in the aorta, radial artery, right atrium, esophagus, and rectum (intra-abdominal). Author

N64-16807 Mayo Clinic, Rochester, Minn. Mayo Foundation
USE OF THE HUMAN CENTRIFUGE TO STUDY CIRCULATORY, RESPIRATORY AND NEUROLOGIC PHYSIOLOGY IN NORMAL HUMAN BEINGS AND A DESCRIPTION OF AN ELECTRONIC DATA PROCESSING SYSTEM DESIGNED TO FACILITATE THESE STUDIES Technical Report, 23 Aug. 1960–1 Nov. 1961
Earl H. Wood, William F. Sutterer, Hiram W. Marshall, and A. Clark Nolan Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs. (6570th), Dec. 1963 30 p refs
(Contract AF 33(616)-7594)
(AMRL-TDR-63-105; AD-431207) OTS: $1.00

The following topics are discussed: (1) the use of the human centrifuge as a tool in the study of physiology, particularly neurologic, respiratory, and circulatory physiology; (2) the complexity of the analytical problems concerned in these studies, which prompted the use of electronic data-processing procedures and equipment; and (3) the hardware that has been assembled and initial plans for the use of this equipment. Author

N64-16808 Mayo Clinic, Rochester, Minn. Mayo Foundation
PHOTOELECTRIC EARPIECE RECORDINGS AND OTHER PHYSIOLOGIC VARIABLES AS OBJECTIVE METHODS OF MEASURING THE INCREASE IN TOLERANCE TO HEADWARD ACCELERATION ($+G_z$) PRODUCED BY PARTIAL IMMERSION IN WATER
Earl H. Wood, Evan F. Lindberg, Charles F. Code, and E. J. Baldes Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs. (6570th), Dec. 1963 23 p refs
(Contract AF 33(616)-7594)
(AMRL-TDR-63-106; AD-431208) OTS: $0.75

The protection against the effects of headward acceleration afforded the human by his immersion in water to the level of the xyphoid and to the third rib at the sternum has been assayed in 15 trained centrifuge subjects. Variations in ear opacity, ear opacity pulse, heart rate, respiration and reaction times to auditory and visual stimuli were recorded continuously in a series of 15 subjects during 15-second exposures to acceleration while seated in a steel tub mounted in the cockpit of the Mayo centrifuge. The level of acceleration was increased by increments of 0.5 to 1.0 $+G_z$ until complete loss of vision (blackout)

was produced when the tub was empty (control) and when filled with water to the level of the xyphoid and also to the third rib at the sternum. The decrements in ear opacity associated with the various degrees of visual impairment were closely similar; however, the decrements in ear opacity pulse and increments in heart rate were significantly less during immersion in water than when in air. Author

N64-16809 Mayo Clinic, Rochester, Minn. Mayo Foundation

TECHNICS FOR MEASUREMENT OF INTRAPLEURAL AND PERICARDIAL PRESSURES IN DOGS STUDIED WITHOUT THORACOTOMY AND METHODS FOR THEIR APPLICATION TO STUDY OF INTRATHORACIC PRESSURE RELATIONSHIPS DURING EXPOSURE TO FORWARD ACCELERATION ($+G_x$) Technical Report, 1 Dec. 1961-30 Mar. 1962

E. H. Wood, A. C. Nolan, D. E. Donald, A. C. Edmundowicz, and H. W. Marshall Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs. (6570th), Dec. 1963 16 p

(Contract AF 33(657)-8899)

(AMRL-TDR-63-107; AD-431209) OTS: $0.50

Pleural pressures were recorded simultaneously from the ventral and dorsal regions of the thorax using fluid-filled catheters inserted through the chest wall via No. 16 needles using an air-tight technic. Pressures were referenced to the catheter tip levels determined by A-P and lateral roentgenograms taken prior to and after a series of 1- to 3-minute exposures of 8 anesthetized dogs to accelerations of 2, 4, and $6G_x$ (supine horizontal and 15° head-up and head-down positions). The negativity of intrapleural pressure in the ventral thorax was uniformly increased during exposures and the intrapleural pressure in the dorsal thorax became positive. Esophageal and pericardial pressures were similar or somewhat less negative than the intrapleural pressure at the same horizontal plane in the thorax. All dogs showed decreases in arterial oxygen saturation during exposures to $6G_x$ when breathing air or 99.6% oxygen. Author

N64-16810 Michigan U., Ann Arbor School of Medicine

VESTIBULAR SUPPRESSION Technical Report, 1 Mar. 1961-28 Feb. 1963

Brian F. Mc Cabe Wright-Patterson AFB, Ohio, Biophysics Lab., Nov. 1963 28 p refs

(Contract AF 33(616)-7959)

(AMRL-TDR-63-119; AD-431210) OTS: $0.75

Repeated stimulation of the vestibular endorgan of the inner ear produces a response decline, which has been termed vestibular suppression. Machinery was constructed to produce high rotary acceleration in a finely controlled manner to study this phenomenon in cats. Suppression was found to be long lasting (greater than 2 months) and to reach about 60% of original response (maximally 75%). It was most rapidly produced at just submaximal levels of stimulus (4 rps^2). Intensity function studies, nerve block studies, and increment–decrement intensity function curves not only failed to show presence of functional endorgan damage due to high rates of deceleration, but demonstrated the endorgan to be a good deal more rugged than is generally recognized. Transference of effects between the otolith organs and ampullae, using rotation and linear acceleration, was absent. The locus of suppression was shown (by stereotaxic coagulation of brain areas, with subsequent release of suppression) to be most likely in the pontine reticular formation and not in the nucleus fastigius. Author

N64-16812 General American Transportation Corp., Niles, Ill. MRD Div.

METHOD OF HEATING FOODS DURING AEROSPACE FLIGHT Technical Report, 19 Feb. 1962-15 May 1963

P. P. Nuccio and S. J. Lis Wright-Patterson AFB, Ohio, Biomedical Lab., Dec. 1963 40 p refs

(Contract AF 33(657)-7922)

(MR-1187-60; AMRL-TDR-63-135; AD-431163) OTS: $1.25

A feasibility study of methods for heating foods during aerospace flight has shown that electrical resistance heating is the most effective technique. An internal heating probe is more efficient than external heating, but special food containers are required. A full-scale engineering model of an external heating food warmer, capable of heating available food containers, was designed, fabricated, and evaluated. This model has three separately controlled stations for mounting flexible heaters that are wrapped around the container to be heated. The system occupies a volume less than 288 $in.^3$ and weighs less than 4 lb, when provided with 6 heater assemblies. Laboratory tests verified that the system meets the requirements specified, and it can heat heat a 6-ounce can of ham and eggs from 75° to 160° F with less than 14 whr of energy. Author

N64-16831 Naples U. (Italy) Inst. of Human Physiology

ON THE PURIFICATION AND IDENTIFICATION OF A SPLENIC FACTOR WHICH PREVENTS RADIATION INJURIES Final Technical Report, 1 Jan. 1963-31 Dec. 1963

Pietro de Franciscis [1963] 13 p

(Contract DA-91-591-EUC-2785)

(AD-432125)

Research is concentrated on isolating the spleen fraction that is able to reduce X-ray mortality. A method is presented for the preparation and purification of a cell-free calf spleen extract. The action of injections of various spleen preparations was recorded for (1) isolated turtle heart and (2) mice subjected to almost lethal total body X-ray irradiation. The reticulocyte response pattern in mice following intraperitoneal treatment with various cell-free spleen extracts has been studied. Author

N64-16860 Joint Publications Research Service, Washington, D.C.

PROBLEMS OF CYBERNETICS

A. A. Lyupunov, ed. 16 Mar. 1964 614 p refs Transl. into ENGLISH from Probl. Kibernetiki (Moscow), no. 8, 1962 p 3–356

(JPRS-23700; OTS-64-21800) OTS: $7.10

CONTENTS:

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1. SET-THEORETIC METHODS IN SYMBOLIC LOGIC Yu I. Zhuravlev p 1–72 refs

2. ON THE DESCRIPTIVE THEORY OF GAMES E. D. Stoitskiy p 73–91 refs

3. ON ONE PROBLEM OF DYNAMIC PROGRAMMING Yu. Yu. Finkel'shteyn p 92–121 refs

4. SYSTEMS OF IDENTITIES FOR ALGEBRAS Yu. I. Yanov p 122–154 refs

THE THEORY OF CONTROL SYSTEMS

5. THE COMPLETENESS THEOREM FOR ONE CLASS OF AUTOMATA WITHOUT FEEDBACK V. B. Kudryavtsev p 155–204 refs

6. MINIMAL RELAY-DIODE BIPOLES FOR NONTONIC SYMMETRIC FUNCTIONS A. A. Markov p 205–212 ref

7. SYNTHESIZING CIRCUITS IN CERTAIN BASES CONTAINING NONTRIVIAL ELEMENTS WITH ZERO WEIGHTS E. I. Nechiporuk p 213–279 refs

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8. AN ASYMPTOTIC ESTIMATE FOR THE ERROR PROBABILITY IN TRANSMITTING INFORMATION OVER A MEMORYLESS CHANNEL WITH FEEDBACK R. L. Dobrushin p 280–292 refs
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PROGRAMMING
10. E-SOLUTIONS OF LINEAR ALGEBRAIC SYSTEMS A. L. Brudno p 331–337
11. SYNTHESIS OF OPERATORS N. I. Glebov p 338–357 ref
12. ALGEBRAIC EQUIVALENCE OF SUBSETS OF CATEGORIES N. I. Glebov p 358–376 refs
13. OPERATOR ALGORITHMS. II (A DESCRIPTION OF BASIC PROGRAMMING CONSTRUCTIONS) A. P. Ershov p 377–407 refs
14. AN ALGEBRAIC TREATMENT OF PROGRAMMING A. A. Lyupunov p 408–422 refs

COMPUTERS
15. MACHINE STABILITY AND USEFUL MACHINE TIME A. L. Brudno p 423–442

PROBLEMS OF MATHEMATICAL LINGUISTICS
16. MACHINE TRANSLATION FROM FRENCH TO RUSSIAN IV. EXPERIMENTAL RESULTS AND ANALYSIS OF ERRORS G. V. Vakylovskaya and O. S. Kulagina p 443–492 refs

CONTROL PROCESSES AND LIVING ORGANISMS
17. A LOGICAL ANALYSIS OF THE STRUCTURE OF GENETIC INFORMATION A. A. Lyupunov and A. G. Malenkov p 493–514
18. COORDINATION OF THE VOLUNTARY MOVEMENTS OF MAN FROM THE STANDPOINT OF THE GENERAL LAWS OF CONTROL AND CONTROLLED SYSTEMS L. V. Chkhaidze p 515–576

BRIEF REPORTS
19. NONGROUP CLOSE-PACKED CODES Yu. L. Vasil'yev p 577–593 ref

CHRONICLE
20. IVTH ALL-UNION MATHEMATICAL CONGRESS [Leningrad, 3–12 Jul. 1961] p 594–610 refs

17 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and materials fabrication, handling and inspection. *For related information see:* 06 Auxiliary Systems.

N64-16233 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TECHNOLOGY OF MACHINE CONSTRUCTION
7 Nov. 1962 26 p refs Transl. into ENGLISH of 2 articles from Tekhnol. Mashinostr., Kuybyshev, Aviats. Inst., 1960 p 61–79
(FTD-TT-62-1248/1+2; AD-292223)

CONTENTS:
1. INVESTIGATING THE DEPTH OF THE COLD-HARDENED LAYER OBTAINABLE IN GRINDING V. T. Dudnikov p 1–3 refs (See N64-16234 08-17)
2. INVESTIGATION OF SOME TECHNOLOGICAL CHARACTERISTICS OF ELECTRIC SPARK WORKING OF HEAT-RESISTANT ALLOYS ON A NICKEL BASE V. P. Aleksandrov p 4–23 refs (See N64-16235 08-17)

N64-16234 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATING THE DEPTH OF THE COLD-HARDENED LAYER OBTAINABLE IN GRINDING
V. T. Dudnikov *In its* Technol. of Machine Construct. 7 Nov. 1962 p 1–3 refs (See N64-16233 08-17)

The discussion is concerned with the cold hardening of metals. Taken into consideration were the effects of cold hardening on the fatigue strength of metals and on machinability. Methods are discussed by which the depth of the cold-hardened layer of different metals may be determined. C.L.W.

N64-16235 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF SOME TECHNOLOGICAL [CHARACTERISTICS OF ELECTRIC SPARK WORKING OF HEAT-RESISTANT ALLOYS ON A NICKEL BASE
V. P. Aleksandrov *In its* Technol. of Machine Construct. 7 Nov. 1962 p 4–23 refs (See N64-16233 08-17)

Research was conducted on the phenomena of electrical erosion under the action of a pulsing electrical discharge. Investigation of the connection between the amounts of erosion of electrodes under the pulse discharge and the quality of the surface with the characteristics of the pulse made it possible to obtain the essential data for the choice of the parameters of the pulses. This assures rational working of heat-resistant alloys on a nickel base. The method of average characteristics is used for obtaining data concerning the amount of the erosion of the electrodes as it depends on the characteristics of the pulse. C.L.W.

N64-16340 Aeroprojects, Inc., West Chester, Pa.
DEVELOPMENT OF ULTRASONIC WELDING EQUIPMENT FOR REFRACTORY METALS Interim Technical Progress Report, Oct.-Dec. 1963
Nicholas Maropis Jan. 1964 22 p refs
(Contract AF 33(600)-43026)
(ASD TR 7-888(7); AD-430644)

Design, development, and construction of the 25-kw spot-type welding machine has continued. Emphasis was placed on performance evaluations of both the modified tension-shell ceramic transducer and the single-element example of the overhung-coupler geometry with its mechanically replaceable welding tip. The four-wafer unbonded ceramic transducer was driven at its design power (a maximum of 3.4 kw) without the former arc-over difficulties, and there was no evidence of untoward unit or circuitry failure. Thermal characteristics of the device proved to be adequate, calorimetric tests demonstrated electromechanical conversion efficiencies of from 52 to 68 percent, and under actual welding conditions the transducer's efficiency was at least twice that of a conventional magnetostrictive transducer. Author

N64-16343 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

BASIC DATA ON VIBRO-ARC SURFACING

A. A. Spiridonov and A. A. Semkin 29 Oct. 1962 14 p Transl. into ENGLISH from Novoye Oborudovaniye Dlya Avtomat. Vibrodugovoy, Moscow-Sverdlovsk, Mashgiz, 1961, p 5–14
(FTD-TT-62-1250/1+2; AD-292233)

Vibroarc surfacing assures the obtaining of thin, uniform, high-hardness metal layers, and thus its application is particularly effective during the restoration of worn details of automobiles, tractors, metal cutting machines, compressors, etc. This report discusses an automatic method for vibroarc beading wherein the electrode is fed at a constant rate and the electrode acquires a vibration with constant frequency and amplitude. As a result, a constant frequency of transition of the electrode droplets is attained. This method requires no special surface preparation, and assures excellent melting of the basic metal with the beaded one as well as high quality of the beaded metal. The method also offers the possibility of obtaining a layer with a thickness of from 0.5 to 3 mm per one pass, and is distinguished by relatively high productivity. At a melting rate of a two millimeter wire of 100 m/hr, the output of the vibroarc beading is 2.6 kg/hr. I.v.L.

N64-16367 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CALCULATION OF THE CHARACTERISITICS OF AXIAL FOREPUMPS

I. V. Mirolyubov 6 Jun. 1963 15 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy, Ser. Aviats. Tekh., no. 1, 1959, p 81–88
(FTD-TT-63-418/1+2+4; AD-412963)

Among the characteristics of axial forepumps discussed are: (1) the dependence of the dynamic pressure drop at the inlet on the flow rate, (2) the change of cavitational specific speed as a function of generalized flow rate, (3) the effect of the change of the impeller radius on the total head, and (4) the effect of a change in the blade length. R.T.K.

N64-16372 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

METHOD OF PROCESSING LIQUID (MOLTEN) METAL

L. A. Verte 12 Jun. 1963 5 p Transl. into ENGLISH from Russian Patent no. 141592, (599092), 8 May 1958, p 1–2
(FTD-TT-63-495/1; AD-413123)

A method is described for processing liquid metal by applying electromagnetic forces. This method permits radical intensification of the process of emersion of nonmetallic inclusions to the surface of the molten metal and increases the completeness of their separation from the metal. R.T.K.

N64-16411 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FOUNDATIONS OF NEW METALWORKING TECHNIQUES

Ye. G. Konovalov 11 Apr. 1963 45 p Transl. into ENGLISH from the book "Osnovy Novykh Sposobov Metalloobrabotki" Minsk, Akad. Nauk BSSR, Fiz.-Tekhn. Inst., 1961 p 92–100, 150–156, and 246–262
(FTD-TT-63-44/1+2; AD-402590)

The following items are discussed with respect to the vibration grinding of equipment: (1) physicomechanical foundations of vibration cutting of metals and alloys; (2) thermal research in vibration grinding of hard alloys; (3) dynamics of rotation drifting; (4) investigation of depths of cold-hardened layers; (5) wear resistance of machined surfaces; and (6) study of residual stresses. P.V.E.

N64-16427 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE FEASIBILITY OF THE USE OF LIQUID-METAL FUSIONS AS LUBRICANTS

A. N. Tynnyy, M. I. Chayevskiy, and V. A. Teterskiy 15 Aug. 1963 10 p refs Transl. into ENGLISH from a Russian book "Voprosy Mashinovedeniya i Prochnosti v Mashinostroyenii" Kiev, Izd. Akad. Nauk Ukr. SSR, v. 9, no. 8, 1962 p 41–46
(FTD-TT-63-574/1+2+4; AD-417413)

The use of fusions of low-melting metals as lubricants in sliding bearings and worm reduction gears is proposed. This use of fusions will eliminate the need for special devices for cooling friction components in high-temperature installations lubricated with mineral oil, and to considerably increase the efficiency of friction pairs. Author

N64-16438 Fansteel Metallurgical Corp., North Chicago, Ill.

COLUMBIUM ALLOY SHEET ROLLING PROGRAM Interim Report No. 5, 7 Nov. 1963–6 Jan. 1964

H. L. Kohn and R. M. Curcio 7 Jan. 1964 20 p
(Contract NOw-63-0231-c)
(AD-430773)

Testing of FS-85 (Cb–27Ta–10W–1Zr) 0.060-in.-thick x 18-in.-wide sheet has been completed. These data are presented. Further processing of B-66 (Cb–5V–5Mo–1Zr) to 0.060-in.-thick sheet is described. Author

N64-16449 Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.

INVESTIGATION OF ELECTROLYTIC HEAT TREATMENT

Robert G. Mahorter and Edward J. Jankowsky 17 Dec. 1963 16 p
(NAEC-AML-1835; AD-429163)

This investigation of electrolytic heating covered the basic parameters of the process including current–voltage relationships, specimen geometry, and electrolyte composition. It was found that the process is well suited to the heat treatment of small parts of relatively simple geometry. Author

N64-16450 General Dynamics/Fort Worth, Tex. Engineering Dept.

REFRACTORY METAL BRAZED SANDWICH DEVELOPMENT AND TESTING

W. T. Kaarlela 28 Dec. 1962 57 p refs
(Contract AF 33(657)-11214)
(ERR-FW-188; AD-429922)

A screening study established the basic process and necessary materials. The process was incorporated into an apparatus for brazing and diffusion bonding a 8-in. X 6-in. structure. The process was then expanded to produce a 12-in. X 12-in. structure. Several good FS-82 columbium alloy panels were brazed with X-71 brazing alloy. Tests on specimens cut from the brazed panels demonstrated the mechanical properties at both room temperature and 2000° F. Author

N64-16464 Aberdeen Proving Ground, Md. Coating and Chemical Lab.

AN ADAPTATION AND EXTENSION OF A QUANTITATIVE INFRA-RED METHOD FOR THE ESTIMATION OF THE NITROGEN RESIN CONTENT OF MODIFIED ALKYDS

M. L. Adams 10 Jan. 1964 13 p refs
(CCL-153; AD-430724) OTS: $0.50

An adaptation and extension of a previously published infrared absorbance ratio method for the anlyasis of vacuum-dried

films of nitrogen-resin-modified phthalic alkyd resins is outlined and shows improved accuracy. The determination of benzoguanamineformaldehyde is included. Author

N64-16475 Arde-Portland, Inc., Paramus, N.J.
CRYOGENIC STRETCH-FORMING OF SOLID-PROPELLANT ROCKET CASES Quarterly Report No. 6, 1 Sep.-30 Nov. 1963
George Claffy [1963] 10 p
(Contract DA-30-069-ORD-3501)
(AD-430537)

The current program status includes the following: (1) Ten subscale preform vessels were fabricated and cryogenically stretched. Four of these were trial units, stretched at various stress levels. The final six units were all stretched at the same stress level to determine reproducibility of shape and conformance to blueprint dimensions. (2) Room-temperature hydrotests were conducted on the four trial subscale vessels. In addition, a vessel that had been stored for one year after cryogenic stretching was hydrotested. Results indicate that properties do not deteriorate with time. (3) Profile measurements were taken on the six subscale vessels, and small deviations from blueprint dimensions were observed in both the forward and aft closures. (4) The fixture for cryogenically expanding the rings for the nozzle-end joint was fabricated and set up for operation. Also, the preform rings of 301 stainless steel, shaped like large conical washers, were fabricated. The rings will turn through an angle as well as stretch in diameter in the expander fixture. I.v.L.

N64-16479 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE HOT MOLDING OF CERAMIC PRODUCTS
P. O. Gribovskiy 10 May 1963 35 p ref Transl. into ENGLISH from the book "Goryacheye Lit'ye Keramicheskikh Izdeliy" Moscow, Gosenergoizdat, 1961 p 4–10, 45–48, 362–373, and 391–394
(FTD-TT-63-146/1; AD-409746)

The following topics are discussed: (1) general fundamentals of the technology of hot molding of ceramic products; (2) molding systems; (3) the manufacturing of the semifinished product; (4) heat treatment; and (5) the practical value and the fields of application of the technology of hot molding. R.T.K.

N64-16576 California U., Berkeley Coll. of Engineering
CRITICAL COMPILATION OF CERAMIC FORMING METHODS Technical Documentary Report, Apr. 1963-Sep. 1963
A. G. Pincus Wright-Patterson AFB, Ohio, AF Mater. Lab., Jan. 1964 422 p refs
(Contract AF 33(657)-10574)
(RTD-TDR-63-4069; AD-431002)

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10. CODING SCHEME ADOPTED FOR THESE BIBLIOGRAPHIES p 84–90
11. INITIAL BIBLIOGRAPHY ON "CHARACTERIZATION OF PARTICLES AND ASSEMBLIES OF PARTICLES" [1958-JUL. 1963] A. L. Mular and V. A. Mee, comp. p 91–211 refs (See N64-16582 08-19)
12. INITIAL BIBLIOGRAPHY ON "FORMING OF CERAMICS" [1955-JUL. 1963] A. G. Pincus, R. E. Rose, and V. A. Mee, comp. p 212–412 refs (See N64-16583 08-17)

N64-16578 Illinois U., Urbana
COLD FORMING PROCESSES
A. W. Allen *In* Calif. U. Critical Compilation of Ceram. Forming Methods Jan. 1964 p 18–32 (See N64-16576 08-17)

The total mechanism of the compaction process, which starts with a particulate system and ends with a shaped piece, is termed compaction response, and is discussed with respect to various forming processes. A diagram is included that shows schematically the progression of materials from base state to fully characterized formed ceramic. The need for fully characterized particulate base and stable agglomerate base materials is discussed. Some general comments on forming system design and smallness and largeness limitations of cold-forming processes are included. E.W.

N64-16579 California U., Berkeley Coll. of Engineering
HOT FORMING PROCESSES
R. M. Fulrath *In its* Critical Compilation of Ceram. Forming Methods Jan. 1964 p 33–43 (See N64-16576 08-17)

The major portion of this document is devoted to uniaxial hot pressing of ceramics. A general description of a typical uniaxial hot pressing system is included, and variations of the system are described. Other methods discussed include hot coining, hot rolling, hot extrusion, hot forging, hot swaging, and methods involving high rates of pressure application. E.W.

N64-16580 Massachusetts Inst. of Tech., Cambridge
MELT FORMING PROCESSES
Alfred R. Cooper *In* Calif. U. Critical Compilation of Ceram. Forming Methods Jan. 1964 p 44–65 (See N64-16576 08-17)

Those processes in which, at some stage, the material is in a totally molten or nearly molten state are classified under melt forming. A table is given that outlines the types of melt-forming processes used in ceramics, along with an indication of the types of materials and shapes that are produced. Melt-forming processes are divided into four major groups: glass forming, crystallization of articles originally formed as glasses, forming from melts of nonglassy ceramics in bulk, and forming from individually melted particles. A section is devoted to each of these classes of forming processes, and some general comments on inherent advantages and disadvantages are made. E.W.

N64-16581 Battelle Memorial Inst., Columbus, Ohio
MISCELLANEOUS FORMING METHODS
Donald J. Bowers *In* Calif. U. Critical Compilation of Ceram. Forming Methods Jan. 1964 p 66–76 refs (See N64-16576 08-17)

Several less common but highly useful and strategic forming techniques are discussed. The potential for these techniques is wide, but their usefulness has been limited by economic considerations in many cases. The processes considered are forming from vapors, porous or foamed ceramics, forming from fibers, bulk placement and molding, impregnation and infiltration, reaction sintering, high energy rate forming, electrophoretic forming, and machining and grinding. E.W.

N64-16583 California U., Berkeley Coll. of Engineering
INITIAL BIBLIOGRAPHY ON "FORMING OF CERAMICS" [1955-JUL. 1963]
A. G. Pincus, R. E. Rose, and V. A. Mee, comp. *In its* Critical Compilation of Ceram. Forming Methods Jan. 1964 p 212-412 refs (See N64-16576 08-17)

Forming processes included are cold forming from dry powders, pastes, and suspensions; polymer- and chemically assisted forming; high energy rate forming; forming by melting and casting of nonglassy ceramics in bulk and by hot deposition; and forming of glass, specific shapes, porous bodies, and composites. Also included are theoretical bases of forming, preparations for forming; hot forming; vapor forming; forming from films, filaments, or whiskers; electroforming; general treatments of forming methods; secondary forming, impregnation and infiltration; assembling and joining; products and parts, ceramics for aerospace applications; and radomes. E.W.

N64-16614 Rutgers U., New Brunswick, N.J. Ceramic Research Station
HOT EXTRUSION
In its Inorg. Dielec. Res. [1963] p 69-83 refs (See N64-16609 08-19)

A brief review of the work on hot extrusion of ceramic materials is presented, including the equipment and procedures used. The importance of coextrusion can design is discussed and illustrated. Author

N64-16708* Southern Research Inst., Birmingham, Ala.
A STUDY OF THE INDUSTRIAL APPLICATIONS OF MAGNETIC-PULSE METAL FORMING
A. Clyde Willhelm 5 Jun. 1963 35 p refs
(NASA Contract NAS8-5201)
(NASA CR-55836; Rept. 5930-1486-2) OTS: $3.60 ph, $1.25 mf

A mail survey of 605 metal-related industries was conducted to determine the present role of magnetic-pulse forming (MPF) in industry, to evaluate its future prospects, and to estimate the feasibility of establishing a NASA-sponsored facility in an independent laboratory to aid industry in exploiting the potential benefits of the forming method. The 192 replies received (a 31.8% response) were evaluated on the basis of the total response, the response divided into 10 industry classifications, and the response divided according to 4 different degrees of previous acquaintance with the process. These evaluations resulted in the conclusions that the MPF process has a promising potential that is not being realized by American industry, that more information on basic practical parameters is needed before industry can adequately evaluate the process in comparison with conventional forming methods, and that the establishment of an experimental facility in an independent laboratory would be justified. Author

N64-16781 Mc Donnell Aircraft Corp., St. Louis, Mo.
A LIMITED EVALUATION OF ULTRASONIC SPOT WELDS IN X2020-T6 ALUMINUM ALLOY SHEET
W. E. Ulery 10 Mar. 1964 25 p refs
(Contract AF 33(657)-11215)
(A461; AD-431624)

A limited evaluation of ultrasonically spot welded specimens of X2020-T6 aluminum alloy has been completed. Specimens consisted of single spot lap shear, overlapping spot seams across 3/4-in.-wide strips, and overlapping spot seams lengthwise of 3/4-in.-wide strips. Evaluation consisted of strength tests of the single spots and the overlapping spot seam welds across the specimen width. Metallographic examinations were made of the longitudinal overlapping spot seam specimens and of the cross seam welds after the strength test. Results of strength tests indicate superior strength of the ultrasonic welds in comparison to electrical resistance welds. Deformation is slight, and the welds are free of cracks and internal voids. Author

N64-16792 Mechanical Technology, Inc., Latham, N.Y.
PRELIMINARY RESULTS ON THERMAL-ELASTOHYDRODYNAMICS
H. S. Cheng 21 Oct. 1963 35 p refs
(Contract Nonr-3729-(00) (FBM))
(MTI-63TR48; MTI-23(1-63); AD-423720)

Theoretical results are obtained for the pressure, temperature, and film thickness between two lubricated rolling and sliding cylinders. The preliminary results indicate that the temperature has a significant influence upon the pressure and film shape, particularly for substantial amount of sliding. The pressure and film shapes also indicate strongly that the fatigue is more important at low speed than at high speed. Author

N64-16840 Telecomputing Corp., San Diego, Calif. Narmco Research and Develop.
THE INVESTIGATION OF EXOTHERMIC BRAZING OF REFRACTORY ALLOYS Final Technical Report, 1 Nov. 1962-31 Oct. 1963
Roger A. Long and Ray Williams Dec. 1963 37 p
(Contract N600(19)-59237)
(AD-432137) OTS: $3.60

The following concepts for brazing refractory metals utilizing exothermic reactions were investigated: (1) an external exotherm heat source used to produce a joint with a standard braze alloy; (2) exothermic reactions (internal exotherms) whose reaction products include a metal phase that serves as the braze alloy; and (3) an external exotherm heat source used to produce a joint by means of a fluxing ceramic phase. Studies carried out under concept (2) resulted in exotherms that yielded a satisfactory nickel-manganese braze alloy. Exothermic reactions (external) that act as heat sources (concept 1) were successful in producing high-strength brazed joints with all the refractory metals when using commercially available braze alloys with flow temperatures up to 3,100° F. The feasibility of using a boron "donor" compound to produce an "in-situ" braze alloy with the base metal (concept 3) was proven. Author

N64-16859* National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala.
SELECTED WELDING TECHNIQUES Technology Utilization Notes
Hershel M. Nance et al Washington, NASA [Jan. 1964] 31 p
(NASA SP-5003; originally published as NASA SP-501) GPO: $0.30

Welding tools and techniques employed in the welding of aluminum sheet and plate for large single booster tanks are discussed. These tools and techniques are: (1) a seam tracker

and proximity control unit that has proven effective in the welding of heavy-gage aluminum; (2) segmented backup bars for welding; (3) a vacuum-type backup bar that facilitates repairs in normally inaccessible locations; (4) a fiber glass tape, for backing up welds, which retains and shapes the molten bead without weld contamination; (5) a clamping tool for fusion welding that holds workpieces in near-perfect alignment; (6) the alignment of large-diameter cylinders maintained by d.c. current straight-polarity tungsten-inert-gas track welding; (7) a guide tip developed for feeding filler wire when welding with inert gas processes; and (8) an improved method of electric arc welding using the sigma technique. I.v.L.

18 MATERIALS, METALLIC

Includes cermets; mechanical and physical properties of alloys and metals; and metallurgy. *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Nonmetallic; 33 Stresses and Loads; and 34 Structural Design.

N64-16115 General Electric Co., San Jose, Calif. Vallecitos Atomic Lab.

PROCEEDINGS OF THE USAEC SYMPOSIUM ON ZIRCONIUM ALLOY DEVELOPMENT– CASTLEWOOD, PLEASANTON, CALIFORNIA, NOVEMBER 12-14, 1962, VOLUME II

H. H. Klepfer, comp. Washington, AEC Div. of Tech. Inform., 30 Nov. 1962 293 p refs
(Contract AT(04-3)-189)
(GEAP-4089, Vol. 2) OTS: $7.50 (Vol. 1 & 2)

The proceedings of the symposium covered the following phases of zirconium alloy development: (1) the role of deformation twinning in the plastic deformation of zirconium; (2) a preliminary examination of the formation and utilization of texture and anisotropy in zircaloy-2; (3) tensile properties of zircaloy with oriented hydrides; (4) the oxidation of zirconium binary alloys in 700° C oxygen for times up to 200 days; (5) some effects of pressure on the oxidation of zircaloy-2 in steam and oxygen; (6) the corrosion of zircaloy-2 fuel element cladding in a boiling water reactor environment; (7) electrical properties of ZrO_2 corrosion films—electrical resistance measurements; (8) solute distribution between corrosion films and zirconium alloy substrates; (9) the defect structure of ZrO_2 and HfO_2, (10) the use of a.c. polarography techniques in the determination of hydrogen transport mechanisms in zirconium alloy oxide films; and (11) hydrogen overvoltage at zirconium intermetallics. R.T.K.

N64-16200 National Aeronautical Establishment, Ottawa (Canada) Structures Lab.

EXPERIMENTS ON CUMULATIVE FATIGUE DAMAGE OF A PRECIPITATION HARDENING AND OF A STRAIN HARDENING ALLOY WITH A STEP CHANGE IN TEMPERATURE

J. A. Dunsby Ottawa, Nat. Res. Council of Canada, Oct. 1963 67 p refs
(MS-108; NRC-7666)

Experiments are described in which the test temperature was changed in the course of a fatigue test on unnotched specimens of 24S-T3 aluminum alloy and of type 301 stainless steel. The results show that, under the particular test conditions, the behavior of the stainless steel, which is metallurgically stable at the temperatures involved, may be predicted to an acceptable accuracy by the linear cumulative damage rule. The behavior of the unstable aluminum alloy is more complex, but the average performance may be estimated from the linear cumulative damage rule, provided that suitable data on the properties of the alloy after exposure to elevated temperature are available. Author

N64-16258 Bureau of Mines, Albany, Ore.

COLUMBIUM AND TANTALUM ALLOYS SUITABLE FOR USE AT HIGH-TEMPERATURES

H. R. Babitzke, M. D. Carver, and H. Kato 1964 30 p refs
(BM-RI-6390)

A number of columbium and tantalum alloys were investigated to determine their suitability for use at elevated temperatures. Columbium–vanadium, tantalum–vanadium, and tantalum–hafnium alloys, and also columbium–10 w/o titanium alloys modified with additions of 0.1 to 2 mole % ZrO_2, TiO_2, ZrB_2, TiB_2, ZrC, or TiC were prepared and examined. Workability, tensile properties, and oxidation resistance were tested. Of the columbium alloys studied, the columbium-12 a/o vanadium exhibited the best properties; it compared closely with the columbium-10 a/o vanadium alloy studied in a previous investigation. Author

N64-16259 Bettis Atomic Power Lab., Pittsburgh, Pa.

EFFECTS OF SILICON, NITROGEN, AND OXYGEN ON THE CORROSION AND HYDROGEN ABSORPTION PERFORMANCE OF ZIRCALOY-2

S. Kass, J. D. Grozier, and F. L. Shubert Nov. 1963 45 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-283) OTS: $1.00

The corrosion properties of Zircaloy-2 have been shown to be altered by the presence of small quantities of silicon or nitrogen. Increasing nitrogen contents of the alloys are noted to produce increased total corrosion and decreased time for transition in the weight gain–time kinetics. Silicon additions tend to produce higher weight gain values but, at the same time, render the alloy less susceptible to hydrogen absorption during aqeuous corrosion exposure. The silicon additions, furthermore, minimize the very deleterious effects upon corrosion resistance that occur due to slowly cooling the alloy through or hot working in the alpha plus beta region. A marked dependence of the hydrogen absorption by Zircaloy-2 upon prior thermal treatment was also observed. Author

N64-16315 General Technologies Corp., Alexandria, Va.

REINFORCED METAL COMPOSITES

J. C. Withers [1963] 7 p Presented at the 7th Meeting of the Refractory Composites Working Group, Palo Alto, Calif., 12-14 Mar. 1963

This paper describes investigations of deposited metal matrices reinforced by metal fibers and strengthened by oxide dispersion. Infiltration of a tungsten fiber array was accomplished by electrodeposition of copper and the vapor deposition of nickel around tungsten fiber arrays. In order to avoid the problems of powder metallurgy and produce a dispersion-strengthened alloy free of process contamination, studies were undertaken to produce billets made by deposition. Small billets of nickel–aluminum oxide were made by an electrodeposition technique and a vapor deposition technique. R.T.K.

N64-16346 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

COLD HARDENING AND RECRYSTALLIZATION OF EI617 ALLOY

Ya. M. Okhrimenko, M. S. Tsibanova, and N. S. Shibalov 31 Oct. 1962 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavednil, Chern. Met. (Moscow), no. 3, 1962 p 95–102
(FTD-TT-62-1318/1+2; AD-292200)

The phenomenon of cold hardening and recrystallization of an EI617 steel alloy under impact deformation was investigated. Results include the following. The grains were extended in the direction of metal flow at 850°, 900°, and 950° C. This extension of the grains appears to be the result of their deformation and indicates the nonremoved cold hardening of the alloy. At 1,000° C, independent of the degree of deformation, a fine equiaxial grain is formed that indicates past recrystallization. As the temperature rises, along with the recrystallization treatment, there is a collective recrystallization that leads to gradual grain growth. Thus, the end recrystallization temperature, at impact loads, is set at exactly 1,000° C. Also, the plasticity of the alloy, in cast and forged states, was determined during precipitation on the pile driver and on the eccentric press at the temperature range of 850° to 1,250° C. I.v.L.

N64-16414 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STUDYING THE HARDNESS OF TUNGSTEN AT TEMPERATURE RANGES OF FROM 20-2700°
G. S. Pisarenko and V. O. Borisenko 3 Apr. 1963 8 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR (Kiev), no. 8, 1962 p 1053–1056
(FTD-TT-63-101/1+2; AD-402600)

The temperature of the sample in the range 20° to 2,000° C was measured with the aid of thermocouples and controlled by an optical pyrometer. For the temperature range 20° to 1,750° C, hardness was measured, using the method of static impression with a sapphire indentor. At temperatures of 1,750° to 2,700° C, hardness was determined by unilateral flattening of conical models. The temperature of the sample, punch, and heater over 2,000° C was measured with the optical pyrometer only. Hardness–temperature dependence data of deformed and annealed tungsten are presented in graphs. The hardness–temperature dependence curves consist of three rectilinear sections with characteristic breaks in low-temperature and high-temperature zones. E.W.

N64-16423 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PHASE ANALYSIS OF SOME ALLOYS DIFFICULT TO FORM
N. I. Blok and N. F. Lashko 17 Jun. 1963 8 p Transl. into ENGLISH from the book "Khimicheskiy Kontrol' Proizvodstva v Metallurgicheskoy i Metalloobrabatyvayushchey Promyshlennostii" Dnepropetrovskoye Knizhnoye Izd., 1960 p 246–250
(FTD-TT-63-479/1; AD-412941)

The base-strengthening α^1-phase of Ni-Cr base alloys as well as their carbide and boride phases was investigated. The electrolyte used in the isolation of the base-strengthening phase consisted of 10 g $(NH_4)_2SO_4$, 10 g $C_6H_8O_7 \cdot H_2O$, and 1,200 ml of H_2O. The electrolyte used in isolating the carbide and boride phases consisted of 1,050-ml No. 81 methanol, 50-ml HCl, and 100-ml glycerin. Results indicate that: (1) The base-strengthening phase that is formed in Ni-Cr base alloys is, as a rule, metastable. It contains, besides Ni, Al, and Ti, small quantities of Cr, Mo, W, Si, Mn, Nb, V, and Co. The composition of the α^1-phase, in the relatively equilibrized state, approximates $Ni_3(Al, Ti)$. (2) Three principal types of carbides in Ni-Cr base alloys are formed. These are $Me_{23}C_6$, $Me^1_hMe^2_mC$, and MeC. The most stable of the carbides is the type MeC. (3) The boride of chromium is formed in Ni-Cr alloys that do not contain Mo or W. A complex boride, which contains Cr, Mo, and W, is formed in alloys containing a considerable amount of Mo and W. The basic element Ni does not go into the boride phase. Up to 0.06% of boron is dissolved in alloys of the type EI-437 and ZhSZ at high temperatures. During aging, this boron is completely combined as borides. I.v.L.

N64-16531 Oak Ridge National Lab., Tenn.
CORROSION OF REFRACTORY METALS BY LITHIUM
James Richard Di Stefano (M.S. Thesis—Tenn. U.) Mar. 1964 92 p refs
(Contract W-7405-ENG-48)
(ORNL-3551) OTS: $2.00

Investigations were conducted on the presence of small quantities of oxygen in niobium and tantalum and the subsequent decrease of their resistance to dissolutive attack by lithium. Penetration of niobium and tantalum by lithium results in formation of a complex corrosion product in grain boundaries and crystallographic planes, reducing the tensile strength and ductility. It was shown that the addition of zirconium was effective in eliminating lithium penetration. Alloys that were heat treated in such a way that oxygen was tied up as zirconium oxide did not corrode. C.L.W.

N64-16536 Oak Ridge National Lab., Tenn.
MECHANICAL PROPERTIES OF X8001 AND 6061 ALUMINUM ALLOYS AND ALUMINUM-BASE FUEL DISPERSION AT ELEVATED TEMPERATURES
W. R. Martin and J. R. Weir Feb. 1964 35 p refs
(Contract W-7405-ENG-48)
(ORNL-3557) OTS: $0.75

The properties of the X8001, 6061, and the U_3O_8-Al dispersion were investigated. The creep properties of these materials in uniaxial tension were measured in the temperature range of 400° to 600° F for maximum strains of 1.0% and times of 450 hr. The tensile properties were measured from 70° to 600° F. The 6061-0 is stronger in short-time tension and creep than the X8001-0 material. The tensile strength of X8001 can be increased by cold working. Recovery of the cold-worked X8001 and 6061 alloys was investigated and compared with the kinetics of the overaging of the 6061 alloy in the T6 condition. The fuel dispersion is stronger in creep than the X8001-0 matrix material. The tensile strength of the fuel dispersion is approximately twice that of X8001-0. Author

N64-16550 General Electric Co., San Jose, Calif.
MATERIALS FOR SUPERHEAT FUEL SHEATHS. RELATIVE PERFORMANCE OF ALLOYS IN SUPERHEATED STEAM ENVIRONMENTS
F. A. Comprelli, D. F. Mac Millan, and C. N. Spalaris Washington, AEC Div. of Tech. Inform., Jul. 1963 103 p refs
(Contract AT(04-3)-189)
(GEAP-4351) OTS: $2.25

Experiments were conducted to obtain relative comparisons of alloy behavior in actual and simulated nuclear superheated-steam environments. These studies were undertaken in order to select a sheath material or a group of materials for further study and possible use in the design and fabrication of fuel elements. The investigations included: (1) study of radiation effects upon the tensile properties of the alloys; (2) corrosion behavior in the absence and presence of stress; (3) effect of prolonged, high-temperature exposures upon structure sensitive properties of the alloys; and (4) physical metallurgical changes as a function of exposure in a superheat environment. Author

N64-16602 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONTEMPORARY PROBLEMS OF PHYSICAL METALLURGY
2 Jul. 1963 89 p refs Transl. into ENGLISH of reports presented at a Seminar, Leningrad, May 9–11, 1961
(FTD-TT-63-510/1+2+4; AD-412885)

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3. TWO-PHASE DECOMPOSITION OF SOLID SOLUTIONS P. I. Filimonov p 28–46 refs (See N64-16605 08-25)
4. PERFECTION AND STRENGTH OF CRYSTALS E. M. Nadgornyy p 47–69 refs (See N64-16606 08-25)
5. BEHAVIOR OF NONCUBIC POLYCRYSTALLINE METALS IN THERMAL CYCLING V. A. Likhachev p 70–85 refs (See N64-16607 08-18)

N64-16603 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE K-STATE IN ALLOYS
V.S. Mes'kin *In its* Contemp. Probl. of Phys. Met. 2 Jul. 1963 p 2–13 refs (See N64-16602 08-18)

In palladium alloys containing from 13% to 25% tungsten and palladium and from 5.5% to > 10% molybdenum that have been annealed with slow cooling after work hardening, an anomaly is observed in the electrical resistance and its temperature coefficient and is explained by the formation of the K-state. The primary cause of the K-state is apparently the establishment, in the solid solution, of a short-range order that induces an increase in hardness and a decrease in plasticity. The electrical resistance anomaly and the change in other electrical properties are the result of the supplementary (to alloying) change in the electron configuration of atoms, which is facilitated by the short-range order and which leads to a decrease in the number of s-electrons. Author

N64-16604 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INTRAPHASE DECOMPOSITION (K-STATE) AND ITS SIGNIFICANCE IN PRESENT-DAY ALLOYS
S. V. Dianov *In its* Contemp. Probl. of Phys. Met. 2 Jul. 1963 p 14–27 refs (See N64-16602 08-18)

Processes of intraphase decomposition have a substantial effect on the formation of heat-resistant properties of alloys, by promoting an increase in the recrystallization temperature and interatomic binding energy in the crystal lattice. The magnitude of the activation energy of the process of intraphase decomposition coincides with the activation energy in diffusion of atoms in metals and alloys and depends on the content of alloying elements. Cold deformation causes a decrease in activation energy by 15,000 cal/g-atom. The value of the activation energy of the process of the formation of the K-state can apparently serve as a characteristic of the refractoriness of alloys. Author

N64-16607 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BEHAVIOR OF NONCUBIC POLYCRYSTALLINE METALS IN THERMAL CYCLING
V. A. Likhachev *In its* Contemp. Probl. of Phys. Met. 2 Jul. 1963 p 70–85 refs (See N64-16602 08-18)

Anisotropy with the thermal coefficient of expansion of polycrystalline materials can be the cause of irreversible thermal changes in dimension, thermal fatigue, and an increase of the creep rate during thermal cyclings. To eliminate the change in dimension it is expedient to use coarsegrained materials devoid of texture. To eliminate thermal fatigue it is expedient to use fine-grained material with a clearly expressed texture. At small applied stresses the increase of the creep rate can be avoided by rational selection of the texture. At large external loads the creep rate is highly increased regardless of the state of the material, and up to now a method of combating this effect has not been found. Author

N64-16631 General Dynamics/Fort Worth, Tex.
SURFACE TRANSFORMATIONS IN AN IMPACTED STEEL ROD
R. D. Potter 15 Jan. 1964 19 p
(Contract AF 33(657)-11214)
(ERR-FW-213; AD-430353)

An SAE 1035 steel was impacted on its end, resulting in ablation of the steel surface by a highly plastic material flowing under the impact effect and causing high rate transformations of the steel's microstructure. Author

N64-16635 General Dynamics/Fort Worth, Tex.
BRAZED TITANIUM – ATMOSPHERIC EXPOSURE-EVALUATION
E. W. Turns 15 Jan. 1964 5 p ref
(Contract AF 33(657)-11214)
(FTDM-2988; AD-430513)

Two brazed RS 140 titanium panels were placed on the laboratory roof at a 45° inclination facing south. Panel S/N 703467 was removed after 1 year of weathering, and panel S/N 723927 was removed at the end of a 2-year period. Upon removal, the panels were cut up and physically tested (load tests), as described in FZR-125. Results are: (1) The data reduction on the 1-year test panel shows that either the panel braze was of inferior quality or that the strength had been lowered by weathering. Failure occurred primarily in the braze alloy rather than at the braze-to-titanium interface. (2) The data reduction on the 2-year test panel shows that the panel obviously had adequate strength. Examination of test failure areas revealed predominant core-to-braze alloy-interface failures, with no evidence of any type of corrosion. Thus, it can be concluded that 2 years of weathering on the brazed titanium panel did not appreciably affect its physical strength. I.v.L

N64-16703* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EFFECT OF SOLIDIFICATION RATE ON THE BETA PHASE IN 5456 ALUMINUM ALLOY
H. H. Kranzlein 7 Dec. 1963 27 p refs
(NASA TM X-54616; MTP-P&VE-M-63-18) OTS: $2.60 ph, $1.01 mf

The presence of beta phase (Mg_5Al_8) in the microstructure of welded 5456 aluminum alloy may be detrimental to the strength and corrosion properties of the welds. In this investigation, the influence of solidification rate on the quantity, distribution, and particle size of the beta phase was established to determine if control of the phase is feasible through regulation of the solidification rate. Experiments with small castings indicate that limited control of the quantity and distribution of the beta phase is possible. Author

N64-16734* Aluminum Co. of America, New Kensington, Pa. Alcoa Research Labs.
INVESTIGATION OF THE STRESS-CORROSION CRACKING OF HIGH-STRENGTH ALUMINUM ALLOYS Second Quarterly Report, 1 Aug.-31 Oct. [1963]
B. W. Lifka 14 Nov. 1963 21 p
(NASA Contract NAS8-5340)
(NASA CR-55857) OTS: $2.60 ph, $0.83 mf

All of the transverse 0.125-in.-diam tension bars have now been exposed to 3.5% NaCl alternate immersion, and specimens for atmospheric sites have all been stressed and are currently being framed for exposure. Ten of the 14 surface treatments have been applied, and alternate immersion tests initiated on the 0.500-in.-diam-tension bars and ring specimens of those 10 systems. Specimens intended to evaluate an intentionally damaged coating have been submitted for machining of a peripheral score mark. Framing operations have been started on specimens intended for atmospheric environments. Control tests on specially aged items for the mechanism study indicate the desired range of susceptibility to stress-corrosion cracking for both 7075 and 2024 alloys. The specimens required for this program have been obtained. Author

N64-16782 Mc Donnell Aircraft Corp., St. Louis, Mo.
MACHINABILITY OF H-11 STEEL IN THE AS-FORGED AND HEAT TREATED CONDITIONS [Final Report]
J. A. Maloney et al 10 Mar. 1964 23 p
(Contract AF 33(657)-11215)
(A463; AD-431505)

The Systems Laboratory of McDonnell Aircraft Corporation conducted producibility tests on machining large H-11 steel parts. This material is readily heat treated to strength levels in the 220,000 to 240,000 psi level, so machinability tests were conducted on H-11 steel in both the annealed and heat-treated conditions. One test specimen was machined to finished shape, then tested to determine the extent of fixturing necessary to prevent distortion during heat treatment. The test results showed H-11 steel to be readily machinable in the annealed condition and well adapted to heat treatment in existing facilities, if properly supported by strain-relief fixturing. While H-11 steel can be machined in the heat treated conditions, tool life and metal removal rates are very poor. Author

N64-16783 Mc Donnell Aircraft Corp., St. Louis, Mo.
OVERLAP, CLEARANCE AND SPECIMEN WIDTH OF BRAZED PH15-7Mo JOINTS [Final Report]
Frank J. Coffey 10 Mar. 1964 19 p
(Contract AF 33(657)-11215)
(A465; AD-431506)

Tests were conducted to evaluate the shear strength of brazed joints with thin sheets of base metal, and to determine the shear strength variation as caused by joint clearance and length of overlap. PH 15-7 Mo stainless steel was selected as the base metal, and Lithobraze 925 as the braze alloy. At minimum joint clearance, an increase in overlap caused a reduction in the shear strength, determined at both room temperature and at 800° F. The maximum shear strength developed at room temperature (20,700 psi) resulted from a 5t overlap; the maximum developed at 800° F resulted from a 3t overlap. The effect of joint clearance was not determined due to the severe surface contamination encountered on all exposed PH 15-7 Mo surface. Since the braze alloy flow and filleting on the exposed base metal surfaces were unsatisfactory, testing was discontinued. Author

N64-16784 Mc Donnell Aircraft Corp., St. Louis, Mo.
METALLURGICAL EXAMINATION OF LB-2 COATED TITANIUM BOLT AND SHEET
G. Morris 10 Mar. 1964 7 p
(Contract AF 33(657)-11215)
(A466; AD-431507)

Metallurgical examination of the subject 6Al-4V titanium bolt and AMS4901 titanium sheet showed no detrimental effects that resulted directly from the application of an LB-2 slurry coating. The coating appears to be porous and brittle in some areas on the bolt; the LB-2 coating on the titanium sheet showed numerous cracks. Dissolution of the base metal in either the bolt or sheet was not in evidence. Author

N64-16785 Mc Donnell Aircraft Corp., St. Louis, Mo.
MECHANICAL PROPERTIES OF 6Al-4V TITANIUM WELDMENT
James Krieg 10 Mar. 1964 8 p
(Contract AF 33(657)-11215)
(A467; AD-431633)

The mechanical properties of 6Al–4V titanium weldment made with commercially pure titanium filler were determined. The mechanical properties of the tensile specimens are listed in tabular form. Microhardness survey results show the heat-affected zone to be harder than either the weld bead or the base material. All tensile specimens, prepared without removal of the weld bead, failed in the base material outside the heat-affected zone. Author

N64-16786 Mc Donnell Aircraft Corp., St. Louis, Mo.
METALLURGICAL EXAMINATION OF HASTELLOY X FOR CORROSION
G. Morris 10 Mar. 1964 4 p
(Contract AF 33(657)-11215)
(A468; AD-431508)

Three pieces of Hastelloy X sheet material were pickled for 1 hour in a nitric–hydrofluoric solution after being cooled slowly from 2,150° F in the following manners: (1) air cooled; (2) cooled between two steel plates that were preheated to 2,150° F; and (3) cooled in a box of heated mica. Intergranular attack was evident in each of the three specimens examined. Mica appeared to produce the most severe intergranular attack. Air cooling appeared to produce the least amount of surface attack of the three cooling methods evaluated. Author

N64-16787 Mc Donnell Aircraft Corp., St. Louis, Mo.
ELEVATED TEMPERATURE TESTS OF CHROMIUM-TITANIUM-SILICON COATED F48 COLUMBIUM ALLOY BOLT AND NUT
Robert R. Wilcox 10 Mar. 1964 7 p
(Contract AF 33(657)-11215)
(A474; AD-431856)

The test bolt and nut were subjected to four 1/2-hour cycles of exposure to 2500° F and cooled to room temperature. Prior to, and after each exposure the bolt and nut were weighed to 0.0001 grams and the weight gain determined. Following thermal cycling the bolt and nut were cross sectioned and metallographically examined, photographed, and coating thickness measured on the bolt shank and thread areas. The initial weight of bolt and nut was 11.0382 grams. The nut froze up after first exposure. The final weight of bolt and nut was 11.0544 grams. Visual examination of the bolt and nut after the temperature exposures exhibited blemishes of chromium oxides on both bolt and nut. Author

N64-16830 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
METALS JOINING. REVIEW OF RECENT DEVELOPMENTS
R. M. Evans 28 Feb. 1964 4 p refs
(AD-431252) OTS: $1.10

Recent developments in metals joints are reviewed. The effect of inert-gas–tungsten arc, electron beam, and resistance spot-welding variables on the weld properties of the niobium alloys, FS-85, B-66, D-36, and Nb-752 were determined. The Ti-13V-11Cr-3Al alloy and a Ti-Cr alloy have been proven suitable for brazing D-36 Nb joints that are to be subjected to temperatures above 2,000° F when in use. A novel technique was reported for producing the Ti-Cr alloy in foil form. A Ti foil 0.0015 inch thick was coated with Cr by vapor deposition. Following coating, the foil was given a diffusion treatment, for less than 1 minute at 2,450° F, to produce a homogeneous alloy. The effect of simulated brazing cycles on the room-temperature properties of several Nb alloys, TZM Mo, and T1,11 Ta alloy are reported. Also, the effect of various inert-gas–tungsten arc-welding parameters on the bend ductility in TZM Mo is reported. The results of diffusion-bonding, electron beam, inert-gas–tungsten, and resistance welding studies on TD Ni are discussed. A new metallizing process for producing high-purity alumina is described. A slurry containing 98% W and 2% Y is painted on the ceramic, and then is sintered in wet H_2 at 3,000° F for 45 minutes. I.v.L.

N64-16833 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
FIBER-REINFORCED MATERIALS. REVIEW OF RECENT DEVELOPMENTS
H. J. Wagner 6 Dec. 1963 3p refs
(AD-432121) OTS: $1.10

Recent developments in the following areas are discussed: (1) influence of oxygen on bonding of alumina whiskers to iron; (2) analysis of stresses in alumina-whisker-reinforced composites, (3) high-temperature reinforcement of silver by alumina whiskers; (4) attempted reinforcement of aluminum with beryllium fibers; (5) aluminum-coated glass fibers; (6) aluminum reinforced by stainless steel; and (7) applications—composite seal materials and extrusion dies. P.V.E.

N64-16838 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
NICKEL-BASE AND COBALT-BASE ALLOYS. REVIEW OF RECENT DEVELOPMENTS
D. A. Roberts 21 Feb. 1964 2 p refs
(AD-432123) OTS: $1.10

Recent developments in nickel-base and cobalt-base alloys are reviewed. A new weldable wrought nickel-base superalloy, René 62, has been developed. René 62 sheet, because of its slow response to aging and excellent high-temperature ductility, is reported to be resistant to weld cracking. This characteristic, combined with somewhat higher strength than Iconel Alloy 718, makes René 62 a promising sheet material for service up to 1500° F. The strengthening of the new alloy is attributed primarily to the precipitation of the gamma-prime phase, Ni_3(Al, Ti, Nb), during aging. The Nb in this phase is reported to slow down the aging response. A significant characteristic of the new alloy is the absence of a region of low ductility above 1100° F. The manufacture of superalloy filaments up to 100 ft in length, by cold stretching, has been proved feasible. Elgiloy, a cobalt-base alloy wire, was selected for the preliminary developmental work in this manufacturing process. The correlation of the forging temperature and carbide phases in Waspaloy is discussed, and the composition and rupture strength of the nickel-base alloy, SM211, are presented. I.v.L.

N64-16848 Massachusetts Inst. of Tech., Cambridge
EFFECT OF PROCESSING HISTORY ON FRACTURE OF MATERIALS AT HIGH STRENGTH LEVELS Technical Documentary Report, 1 May 1962-1 May 1963
D. R. Poirier, M. L. Ebner, M. C. Flemings, and W. A. Backofen Wright-Patterson AFB, Ohio, Aeronautical Systems Div. Sep. 1963 60p refs
(Contract AF 33(657)-9169)
(ASD-TDR-63-819, Pt. 1; AD-431759) OTS: $5.60

The influence of melting and solidification variables on the fracture toughness of AISI 4340 steel at a yield strength of 240,000 psi was studied. In this initial part of the program, four different ingot structures were obtained by casting air-melted 4340 steel into four different types of molds: (a) a sand mold, (b) a cast iron chill mold, (c) a "hot" mold lined with exothermic material, and (d) a mold producing unidirectional solidification. All the ingots contained dendritic segregation (microsegregation), inclusions, and microporosity. The size of inclusions, the volume of microporosity, and the dendrite arm spacing all increased as the rate of solidification decreased. Microsegregation and microporosity were found in sheet material in spite of deformation processing and the inclusions were elongated in the rolling direction. All material tested (air-melted and cast) had a fracture toughness typical of air-melted AISI 4340 steel but was inferior to the best quality vacuum melted steel of this type. Author

N64-16881 McDonnell Aircraft Corp., St. Louis, Mo.
DETERMINATION OF MECHANICAL PROPERTIES AND SURFACE CONDITION OF CHEM-MILLED Cb-5Zr COLUMBIUM ALLOY SAMPLES
H. Jacobus 10 Mar. 1964 6 p
(Contract AF 33(657)-11215)
(A473; AD-431617)

Two alloy specimens, submitted for testing, were sectioned for metallographic examinations, and two Type F-3 tensile specimens were fabricated for determination of Ftu, Fty, and % elongation. The surface condition of each specimen is shown at 500X, 250X, and 100X magnification. Thickness measurements of specimen No. 1 showed variations from 0.0131 to 0.0135 and specimen No. 2 from 0.0135 to 0.0154. Specimen No. 1 had a Fty in psi of 45,500, a Ftu in psi of 63,600, and a 23% elongation. Specimen No. 2 had a Fty in psi of 45,600, a Ftu in psi of 63,200 and a 23% elongation. I.v.L.

N64-16885 Atomics International, Canoga Park, Calif.
COMPATIBILITY OF BORON CARBIDE WITH POTENTIAL AOMR CONTROL ROD CLADDING MATERIALS
R. D. Hahn 1 Mar. 1964 25 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-8702) OTS: $0.50

The solid-state compatibility of boron carbides with commercial copper, types 304 and 430 stainless steels, and AISI 4130 steel, for potential control rod application, were investigated at 750°, 950°, 1,100°, and 1,300° F, for periods of 500, 1,000, 5,000, and 10,000 hr. These studies have shown commercial copper and type 430 stainless steel to be compatible with boron carbide at 1,300° F for 10,000 hr. Type 304 stainless steel was compatible with B_4C for 10,000 hr at 1,100° F, but not at 1,300° F. There were no reactions observed in the AISI 4130 steel for 10,000 hr at 750° F, but

a very hard reaction zone that increased in width from 1 mil at 950° F to 10 mils at 1,300° F was observed. The phase formed in the AISI 4130 steel was identified by X-ray diffraction to be primarily Fe_2B. The activation energy for the growth of this phase was calculated to be about 38 kcal/mole. Author

N64-16891 Titanium Metals Corp. of America, New York, N.Y.
DEVELOPMENT OF A STABLE-BETA TITANIUM ALLOY Fourth Quarterly Report, 1 Apr.-30 Jun. 1963
D. B. Hunter Watertown, Mass., Army Mater. Res. Agency [1963] 43 p
(Contract DA-30-069-ORD-3743)
(WAL-TR-405/2-3; AD-429131)

Alloy bases Ti-17V-10Cr-3Al, Ti-8Mo-8V-7.5Fe - 3Al, and Ti-15Mo-5Fe-3Al, containing additions of up to 5% of hardening agents such as Cu, Co, and Ni, were water quenched from 1,350° F, instead of plate cooled, but no appreciable difference in aging response was found. A marked aging response found when selected alloys were aged at 850° F in the as-cold-rolled condition was attributed to alpha precipitation. Reduction of the Fe and Cr contents of the original base alloys and a corresponding increase in the Cu content did not significantly improve fabrication properties, but complete replacement of Fe and Cr with Cu in varying amounts produced good quality sheet. Partial replacement of Fe and Cr by Ni resulted in hot shortness. Author

19 MATERIALS, NONMETALLIC

Includes mechanical and physical properties of nonmetals (e.g., plastics). *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N64-16314 Union Carbide Nuclear Co., Oak Ridge, Tenn.
A SURVEY OF HIGH-COMPRESSIVE STRENGTH OXIDES AND CARBIDES
R. P. Levey, Jr. 20 Feb. 1964 40 p refs
(Contract W-7405-eng-26)
(Y-1450) OTS: $1.00

Composite, hard-grain, ductile matrix bodies of high compressive strength can be produced by isostatic pressing at 200,000 to 300,000 psi and by firing at temperatures well below those normally employed for sintering comparable compositions. The compacts so produced are shown to have outstanding compressive strengths and steel-cutting ability. The preparation, pressing firing, and testing of a number of such mixtures have been achieved. Author

N64-16344 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERMETS-NEW REFRACTORY STRUCTURAL MATERIALS AND THEIR APPLICATION
Zenon Sobczyk 30 Oct. 1962 10 p refs Transl. into ENGLISH from Mech. (Warsaw), v. 34, no. 7, 1961 p 360-361
(FTD-TT-62-1264/1; AD-292188)

Cermets are materials derived by combining ceramic powders with metal powders. The combination process is accomplished by using methods applied in powder metallurgy. The physical properties of and uses of cermets are discussed. R.T.K.

N64-16349 General Dynamics/Fort Worth, Tex.
FUSELAGE - 4FTB333 - WINDSHIELD SPECIMENS - VARIABLE PIGMENTED EDGE BITES - SOLARIUM DETERIORATION TEST OF -
M. T. Carroll 15 Jan. 1964 6 p
(Contract AF 33(657)-11214)
(FTDM-3104; AD-430326)

By basing the service life of B-58 windshields on the time required for interlayer cracks to progress 2 in. in from the edge of the glass, increasing the pigmented interlayer depth will increase the service life of the windshield. In addition, it should be noted that an increase in the pigmented edge depth will also decrease the daylight opening of the windshield. Author

N64-16350 General Dynamics/Fort Worth, Tex.
FUSELAGE - WINDSHIELD - EXPOSURE TEST
M. T. Carroll 15 Jan. 1964 4 p
(Contract AF 33(657)-11214)
(FTDM-2949; AD-430322)

With the installation of pigmented-edge B-58 pilot-enclosure windshields, the windshield replacement rate due to interlayer degradation was decreased considerably. The use of pigmented edge glass was effective on A/C #57 and on. Airplanes No. 31 and 33 were retrofitted with new glass in order to conduct an in-service test. Data obtained so far show that the glass replacement rate is higher on A/C #57 and on than on A/C #31 and 33. This indicated that the first pigmented windshields received may have been better than the windshields later developed for production use. The purpose of this test was to establish a quality comparison between windshields now received and previously tested pigmented windshields. Author

N64-16370 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERAMIC PROPERTIES OF THE ZrO_2-SiO_2 SYSTEM
R. Pampuch 9 Jul. 1963 24 p refs Transl. into ENGLISH from Prace Inst. Hutnictwa, v. 13, no. 52, 1961 p 229-237
(FTD-TT-63-475/1+2; AD-414979)

This report on the ceramic properties of stabilized and partially stabilized ZrO_2 includes investigations of: (1) the microstructure of ceramic materials and their resistance to sudden change in temperature; (2) the effect of SiO_2 admixtures on the microtexture and on the thermal properties of ZrO_2 agglomerates; and (3) the agglomerization capacity of ZrO_2 and SiO_2 mixtures. Also, discussed are X-ray and dilatometric investigations of the various components of the ZrO_2-SiO_2 system, and investigations of the microtextures of the various components of this system. I.v.L.

N64-16408 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATIONS ON THE PRACTICAL APPLICABILITY OF GERAMIC ELECTRETS
E. Schleicher 15 Feb. 1963 14 p refs Transl. into ENGLISH from Exptl. Tech. der Phys., v. 10, no. 3, 1962 p 224-230
(FTD-TT-62-1925/1+2+4; AD-298656)

The voltage-time behavior of ceramic electrets with closely fitting electrodes is investigated under various discharge conditions. Short charges at 10^{12} ohm can be taken under intervals of five minutes without the electrets showing a noticeable decrease in charge during the period of observation. They can, therefore, be used for charging the capacitors for radiation meters, etc. These ceramic electrets may be considered as "electrostatic accumulators" that can be recharged when they lose

their charge. The storage of the charge takes place in the intermediate layer between the electrode and the dielectric; from thence, the carriers of the charge diffuse onto the metal coating when discharge takes place. Author

N64-16470 Forest Products Lab., Madison, Wis.
STRENGTH PROPERTIES OF REINFORCED PLASTIC LAMINATES AT ELEVATED TEMPERATURES (NARMCO 534 RESIN AND 181-A1100 GLASS FABRIC)
Kenneth H. Boller Wright-Patterson AFB, Ohio, AF Materials Lab., Jan. 1964 45 p refs
(Contract AF 33(657) 63-358)
(RTD-TDR-63-4091; AD-430503)

This report presents properties of a phenyl-silane laminate made of Narmco's formulation 534 of resins and 181-A1100 glass fabric. In general, it is shown that strength properties decrease with increases in temperature. Strengths drop with the first application of heat, but at constant temperatures of 300° and 400° F the exposed material has a tendency to recover some of that lost strength. Continued exposure above 500° F, however, does not result in recovery of strength. From the curves and data presented here, the environmental effects on individual strength properties may be judged separately for temperatures between 80° and 1,000° F, and exposure periods between 0.05 and 1,000 hours. Author

N64-16568 Aerojet-General Corp., Sacramento, Calif.
DEVELOPMENT OF IMPROVED RESIN SYSTEMS FOR FILAMENT-WOUND STRUCTURES
J. J. Cooney 12 Feb. 1964 36 p
(Contract NOw 63-0627c (FBM))
(Rept. 0627-VI-4; AD-430754)

This fourth bimonthly progress report presents results of statistical analyses of property data obtained for resin systems cured with m-phenylenediamine and 4,4'-methylenedianiline, and results of property tests conducted on systems cured with ethylenediamine and hexahydrophthalic anhydride.
Author

N64-16582 California U., Berkeley Coll. of Engineering
INITIAL BIBLIOGRAPHY ON "CHARACTERIZATION OF PARTICLES AND ASSEMBLIES OF PARTICLES" [1958-JUL. 1963]
A. L. Mular and V. A. Mee, comp. *In its* Critical Compilation of Ceram. Forming Methods Jan. 1964 p 91–211 refs (See N64-16576 08-17)

Topics discussed in this bibliography include powder particle preparation, properties of particles, properties of assemblies of particles, mixing and blending, granulation, agglomeration, sintering, and general characterization of particles.
E.W.

N64-16586 Union Carbide Corp., Lawrenceburg, Tenn. National Carbon Div.
RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS, VOLUME 42 Summary Technical Report, May 1, 1960-April 30, 1963
Wright-Patterson AFB, Ohio, AF Materials Lab. Jan. 1964 218 p refs
(Contract AF 33(616)-6915)
(WADD-TR-61-72, Vol. 42; AD-431501)

This report gives a summary of a research and development program on graphite and graphite-base materials. The efforts covered raw materials studies; basic investigations of the elemental graphite crystals; fabrication studies, including scaleup to useful sizes; and characterization and evaluation for applicability to selected weapons systems. A complete listing of other Technical Reports issued under this contract study is presented. Author

N64-16608 Air Products and Chemicals, Inc., Allentown, Pa.
INVESTIGATION OF THE PARA-ORTHO SHIFT OF HYDROGEN [Final Report, Mar.-Sep. 1962]
R. G. Clark, J. F. Kucirka, A. Jambhekar, and G. E. Schmauch Wright-Patterson AFB, Ohio, AF Aero-Propulsion Lab., Oct. 1963 52 p refs
(Contract AF 33(616)-7506)
(ASD-TDR-62-833, Pt. 2; AD-431013)

Investigations of the low-temperature, heterogeneous catalysis of the para–ortho shift of hydrogen for the recovery of the endothermic heat of conversion as low-temperature refrigeration are reported. The research program included: studies of the effects of catalyst activation temperature, particle size, and chamber diameter on conversion activity; adsorption studies; the determination of separation factors of advanced catalysts; and preliminary work to determine the magnetic properties of advanced catalysts. An extensive catalyst development program has resulted in improved catalyst systems for the conversion. The most advanced catalyst shows an activity 10.5 times more effective, on a weight basis, than hydrous ferric oxide gel, which is the best commercial catalyst available for the conversion. Author

N64-16609 Rutgers U., New Brunswick, N.J. Ceramic Research Station
INORGANIC DIELECTRICS RESEARCH Final Report, 1 Nov. 1961-31 Oct. 1963
E. J. Smoke, C. J. Phillips, E. L. Kastenbein, D. R. Ulrich, R. C. Pitetti et al [1963] 98 p refs
(Contract DA-36-039-SC-89141)
(AD-430912)

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3. TRANSPARENT POLYCRYSTALLINE CERAMICS p 23-43 refs (See N64-16612 08-19)
4. LANTHANUM ALUMINO SILICATE DIELECTRICS p 44–68 refs (See N64-16613 08-19)
5. HOT EXTRUSION p 69–83 refs (See N64-16614 08-17)

N64-16610 Rutgers U., New Brunswick, N.J. Ceramic Research Station
DEVITRIFICATION OF $BaTiO_3$
In its Inorg. Dielec. Res. [1963] p 1–14 refs (See N64-16609 08-19)

A ceramic has been produced of very fine crystal size (0.2μ to 0.5μ) by devitrification from a finely powdered barium titanate glass that was fabricated conventionally. This results in a barium titanate crystalline phase that is more tetragonal, and in an increase in the Curie temperature to approximately 150° C. Author

N64-16611 Rutgers U., New Brunswick, N.J. Ceramic Research Station

A STUDY OF BORON NITRIDE AND THE EFFECT OF ADDITIVES ON ITS HYGROSCOPICITY

In its Inorg. Dielec. Res. [1963] p 15–22 (See N64-16609 08-19)

An evaluation of industrial hot-pressed boron nitride reveals that it is both porous and soluble, thereby causing deterioration of its electrical properties under high-humidity conditions. A procedure has been evolved to produce hot-pressible boron nitride, and the parameters have been established to attain optimum properties. Boron nitride thus produced is slightly better than the industrial material evaluated. However, commercial pyrolytic BN of excellent quality is now available that is not affected by moisture. Author

N64-16612 Rutgers U., New Brunswick, N.J. Ceramic Research Station

TRANSPARENT POLYCRYSTALLINE CERAMICS

In its Inorg. Dielec. Res. [1963] p 23–43 refs (See N64-16609 08-19)

In the study of anisotropic crystalline phases, alumina bodies were fired in four atmospheres—hydrogen, oxygen, argon, or vacuum. Fired specimens were evaluated for density, moisture absorption, total porosity, and translucency. Microscopic methods were used to determine grain and pore size. Specimens fired in vacuum exhibited the best results, and argon exhibited the poorest. All specimens exhibited lower transparency than "Lucalox." A higher degree of transparency should be possible with an isotropic crystalline phase than with an anisotropic one. Spinel (magnesium aluminate) was selected for study of the isotropic phase. A prereacting technique was devised to attain excellent uniformity in mixing of the raw ingredients. Specimens were prepared and fired to an average degree of uniformity. Author

N64-16613 Rutgers U., New Brunswick, N.J. Ceramic Research Station

LANTHANUM ALUMINO SILICATE DIELECTRICS

In its Inorg. Dielec. Res. [1963] p 44–68 refs (See N64-16609 08-19)

The object of this phase is the development of low loss ceramics with dielectric constants in the range of 12 to 15. The lanthana–alumina–silica system was selected for study. All the techniques investigated to mature these compositions are presented, with an evaluation of each technique. Problems encountered are also discussed. Electrical properties of composition within the system are given. Correlations of these properties with regard to crystal and glass content, crystalline types, and porosity are also presented. Compositions that which do not contain glass and that are located within the systems $MgO–ZrO_2–TiO_2$ and $CaO–SiO_2$ were evaluated for electrical properties. The procedures and results are presented. Author

N64-16632 General Dynamics/Fort Worth, Tex.

MATERIALS – CHANNEL SEALANTS – FOR USE IN F-111 INTEGRAL FUEL TANKS – SCREENING TESTS OF

J. P. Thomas 15 Jan. 1964 21 p

(Contract AF 33(657)-11214)

(FGT-3041; AD-430324)

Eight channel sealants and one 50-50 mixture of two channel sealants were screened in accordance with the adhesion, low-temperature flexibility, and reinjection properties tests of the proposed F-111 channel sealant specification "Sealing Compound: 375° F Groove Injection (For Integral Fuel Tanks)". Although none of the candidate channel sealants tested passed all of the three screening tests without some qualifications, XS-1402303F and to a lesser extent P-37-8 materials appear to show promise as F-111 integral fuel tank sealants. The silicone sealants tested, with the exception of Q-9-0068, were too "nervy" and exhibited fillet shrinkage when tested for reinjection properties. The Q-9-0068, although it did not possess the "nervy" characteristics of the other silicones, extruded badly from the test jig and resulted in several voids in the fillet, as was observed following the reinjection properties test. Author

N64-16633 General Dynamics/Fort Worth, Tex.

ENVIRONMENTAL CONTROLS – F-111 WINDSHIELD COATING EROSION – DEVELOPMENT TEST

R. A. Lee 15 Jan. 1964 15 p

(Contract AF 33(657)-11214; Contract AF 33(657)-8260-1)

(FGT-3062, Add. 1; AD-430325)

The rain-repellant characteristics of the Z4141 coating remained good after being subjected to 200 hours of air blast at 400 knots velocity. A slight deterioration in the rain-repellant characteristics of the Z4141 coating was evident, but visibility remained good in a simulated heavy rain. Author

N64-16634 General Dynamics/Fort Worth, Tex.

FUSELAGE – B-58 WINDSHIELD POLYMER B AS EXTENDED EDGE MATERIAL – EVALUATION OF –

H. Hoffman 15 Jan. 1964 11 p

(Contract AF 33(657)-11214)

(FTDM-2861; AD-430323)

The use of Polymer B sealant as an extended edge material in B-58 windshields and windshield-fabrication techniques were evaluated. The fabricated windshields were solarium tested and subjected to burst-pressure testing. In all cases, the temperature was 260° F, and the inner ply of the glass was broken before pressure was applied. It is indicated that: (1) The use of Polymer B sealant an extended edge material in B-58 windshields does not appear feasible because of manufacturing difficulties. When an attempt was made to determine the burst pressure of the windshild at 260° F, the glass separated, almost intact, from the edge attachment at a pressure of 1 to 2 psig. (2) Methods of layup, cure, and post-cure that allow for escape of interlayer volatiles show promise of resulting in increased resistance to degradation and increased burst strength of the B-58 windshields. I.v.L.

N64-16636 General Dynamics/Fort Worth, Tex.

MATERIAL-SCREENING TEST OF FILLET AND FAYING SURFACE TYPE SEALANTS FOR F-111

G. M. Warren 15 Jan. 1964 7 p

(Contract AF 33(657)-11214)

(FTDM-3125; AD-430328)

Screening tests were performed on the following sealants after conditioning in the F-111 fuel-tank environment: Dow Corning's Q-9-0002 A/B, Q-9-0104 A/B, Q-2-0046 (with GD/FW CS-48 accelerator); Products Research's P-83-180 (Test Request 30-2693); and Minnesota Mining's EC-2288 A/B. Based on screening tests conducted and described in this report, none of the five sealants appear to be capable of withstanding the environmental conditions specified for F-111 integral fuel-tank sealants. R.T.K.

N64-16637 General Dynamics/Fort Worth, Tex.
MATERIAL – CORROSION PROTECTION COATINGS – FOR USE IN F-111 INTEGRAL FUEL TANKS – SCREENING TESTS OF
G. M. Warren 15 Jan. 1964 5 p
(Contract AF 33(657)-11214)
(FTDM-3126; AD-430329)

The performance and reliability requirements of the F-111 airplane necessitate the use of corrosion prevention coatings in the integral fuel tanks. The coatings investigated for this purpose were screened by selected tests that simulated the F-111 fuel-tank environment, in order to eliminate the inadequate materials from the more extensive and costly evaluation tests. The coatings tested, environmental conditions, and test results are presented in tabular form. R.T.K.

N64-16638 General Dynamics/Fort Worth, Tex.
ROPE– NYLON AND MYLAR– TENSILE PROPERTIES– STATIC AND VIBRATIONAL
F. W. Weber 15 Jan. 1964 10 p
(Contract AF 33(657)-11214)
(FTDM-3159; AD-430512)

Static tensile tests were performed on 1-foot lengths of mylar rope using standard equipment and techniques. The static tensile strengths are tabulated and stress–strain curves are given. Vibrational tests were performed on 4-ft and 40-ft lengths of mylar and nylon rope under various static loadings. Amplitude–time curves, for determination of damping characteristics, were obtained by use of a differential transformer and standard electrical recording equipment. Untwisting torque was measured by means of two hand-held 5-lb spring scales acting on a 20-in. moment arm. The results of the test are presented in table form. E.W.

N64-16681* Rice U., Houston, Tex.
A HIGH TEMPERATURE CALORIMETER; THE ENTHALPIES OF α-ALUMINUM OXIDE AND SODIUM CHLORIDE
Rapier Dawson, Elizabeth B. Brackett (Colgate U.), and Thomas E. Brackett Repr. from the J. Phys. Chem., v. 67, 1963 p 1669–1671 refs
(NASA Grant NsG-6-59)

The construction and operation of a high-temperature calorimeter is described. The enthalpy of a sample of α-aluminum oxide furnished by the National Bureau of Standards has been measured from 750° to 1,400° K and found to be about 0.3% higher than the enthalpy reported by the N.B.S. in the region in which it can be compared. The enthalpy of sodium chloride has been measured and found to fit the equations $(H_T-H_{298.15}) = 10.457T + 0.002442T^2-3334$ cal/mole [600° K < T ≤ 1073.8° K; ±0.2%] and $(H_T-H_{298.15}) = 25.247T-0.003767T^2-5307$ cal/mole [1073.8° K ≤ T < 1300° K; ±0.1%]. Author

N64-16701* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EFFECTS OF GAMMA RADIATION ON SELECTED POTTING COMPOUNDS AND INSULATING MATERIALS
Bobby W. Kennedy 19 Nov. 1963 25 p refs
(NASA TM X-54615; MTP-ASTR-P-63-16) OTS: $2.60 ph, $0.95 mf

Recent radiation tests were performed on the following types of polymeric materials: epoxy, silicone, and polyurethane resins; teflon, polyester film, and Mylar flat-conductor cables. After exposures of up to 10^8 roentgens, mechanical properties were analyzed. Property changes data were then correlated with molecular effects caused by absorption of gamma rays. The manner in which radiation affects the physical properties of common polymeric materials and the specific material irradiated are discussed. It was found that at the maximum doses to which the subject material was exposed, Mylar and polyester films performed well. Teflon performed very poorly under the same conditions. Among the potting compounds, the epoxy resins showed the effects induced by both chain scission and cross-linking. The silicones changed only slightly in physical properties. Test data indicated a gradual degradation in the properties of polyurethane resins. Author

N64-16713* Chance Vought Corp., Dallas, Tex. Astronautics Div.
THE PREDICTION OF OXIDATION RATES OF CARBONACEOUS MATERIALS FROM PLASMA ARC TESTS 00.241
J. K. Haviland and J. E. Medford [1963] 41 p refs Presented at the Sixth Biennial Conf. on Carbon, Pittsburgh U., Jun. 17–21, 1963
(NASA Contract NAS9-576; Contract AF 33(616)-9747; Contract AF 33(657)-8057)
(NASA CR-55837) OTS: $4.60 ph, $1.43 mf

A series of stagnation point plasma arc tests on specimens of carbonaceous material was examined to find out whether the loss of mass could be explained in terms of oxidation of the carbon. Up to a surface temperature of 4,000° F, it was found that it could be predicted in terms of the rate of diffusion of oxygen through the boundary layer, computed by Lewis analogy from the known heat flux and driving enthalpy. Best results were obtained by assuming that carbon monoxide was formed, and by using the net heat flux corrected for hot wall and transpiration cooling effects. Above 4,000° F, it was found that additional mass loss was caused by spalling. It is concluded that sufficient information can be obtained from plasma tests to compute the oxidation and spalling rates of a carbonaceous material on a reentry vehicle. Author

N64-16715* IIT Research Inst., Chicago, Ill. Technology Center
DEVELOPMENT OF SPACE-STABLE THERMAL-CONTROL COATINGS (PAINTS WITH LOW SOLAR ABSORPTANCE/EMITTANCE RATIOS) Triannual Report, 20 May-20 Sep. 1963
Gene A. Zerlaut, E. H. Thomplins, and Y. Harada 25 Oct. 1963 43 p refs
(NASA Contract NAS8-5479; Proj. C6014)
(NASA CR-55826; IITRI-C6014-4) OTS:$4.60 ph, $1.49 mf

Investigations were conducted to decrease the solar absorptance of zinc oxide-pigmented potassium silicate and methyl silicone paints by employing techniques to (1) increase their ultraviolet reflectance without expense to their stability, and (2) maximize their reflectance in the visible and near-infrared portion of the solar spectrum. Also discussed are the reflectance and solar absorptance of various compacted zinc oxide powders, preliminary investigations of the microstructure of potassium silicate paints, the effect of "tumbling" a zinc oxide–silicate specimen in an Alconox–water mixture, and the effect of pigment volume concentration on the spectral reflectance of zinc-pigmented methyl silicone elastomer paints. Author

N64-16741* IIT Research Inst., Chicago, Ill. Technology Center
STABLE WHITE COATINGS Interim Report, 15 Jul.-30 Nov. 1963
Gene A. Zerlaut and Y. Harada 9 Jan. 1964 36 p Prepared for Jet Propulsion Lab.

(NASA Contract NAS7-100; JPL Contract 950111; Proj. C207) (NASA CR-53086; IITRI-C207-27) OTS: $3.60 ph, $1.28 mf

Investigations were continued in the development of white thermal-control coatings possessing good stability to ultraviolet irradiation in vacuum. This report describes studies aimed at the establishment of optimum manufacturing conditions for the three most promising paint systems. Of special importance were the formulation and synthesis parameters; storage, soiling, and cleaning experiments; room-temperature curing studies on the silicone paints; and zinc oxide bleaching experiments. Author

N64-16769* Stanford Research Inst., Menlo Park, Calif.
SPACE ENVIRONMENT EFFECTS ON POLYMERIC MATERIALS Final Technical Report, Oct. 1962-Dec. 1963
R. F. Muraca 8 Dec. 1963 98 p refs Prepared for Jet Propulsion Lab.
(NASA Contract NAS7-100; Contract JPL-950324; SRI Proj. PLU-4257) (NASA CR-55846) OTS: $8.60 ph, $3.14 mf

The thermal degradation of a group of "space grade" polymers in vacuum was studied; degradation of the skeletal structure at temperatures below 125° C was not observable. The syntheses of various deuterated nylons and nylon precursors are described. An apparatus and procedure for determining volatile condensable material given off by polymers at 125° C are described; it is shown that the procedure is of use only for determining the extent to which warm polymers release material that can condense on cooler surfaces and polymerize. Apparatus and procedures for determining physical properties in a vacuum-thermal environment are described. Polymers studied include Vitons, Mylars, silicone rubbers, Teflons, polyurethanes, and nylons. Author

N64-16832 Aeon Labs., Egham (Gt. Brit.)
THE STRUCTURE OF GRAPHITIC MATERIALS. Quarterly Technical Summary Report, 1 Aug. 1962-1 Oct. 1963
R. P. Dennis et al 22 Oct. 1963 17 p refs
(Contract DA-91-591-EUC-1851)
(AD-432138) OTS: $1.60

Arrangements have been made to obtain a supply of a synthetic graphite material manufactured from petroleum coke and a small proportion of natural graphite with a pitch binder. This is supplied in two conditions designated C.Y.9. and E.Y.9., the latter being in the "graphitized" form (heated at 2,500° C). The two types of material are being examined following various heat treatments and creep tests using transmission electron microscopy. Transmission specimens have been prepared by replication of fracture surfaces and by Airbrasive erosion of 3-mm discs cut from 0.5-mm-thick sheet. Author

N64-16846 Melpar, Inc., Falls Church, Va.
A COMPILATION OF CURRENT AVAILABLE DATA ON NONMETALLIC INORGANIC REFRACTORY MATERIALS USED FOR RADOME APPLICATIONS AT ELEVATED TEMPERATURES Second Quarterly Report, 18 Jul. 1963-1 Nov. 1963
L. K. Eliason and G. C. Zellner [1963] 70 p refs
(Contract AF 33(657)-10519)
(AD-432141)

All major manufacturers of nonmetallic inorganic refractory materials, and companies using these materials for radomes at elevated temperatures, were visited. A brief summary of the information obtained from these sources is presented. A detailed analysis was made of all available methods used to measure the dielectric constant and loss tangent. Of these, three were found to be satisfactory, and the test procedures involved are presented along with typical high-temperature data concerning Al_2O_3, SiO_2, and BeO. The progress made to date in the literature survey is also discussed. Author

N64-16870 Monsanto Research Corp., Dayton, Ohio
EVALUATION OF ELASTOMERS AS O-RING SEALS FOR LIQUID ROCKET FUEL AND OXIDIZER SYSTEMS Technical Documentary Report, Sep. 1961-Mar. 1963
Carmen L. Bellanca, Ival O. Salyer, and Jay C. Harris Wright-Patterson AFB, Ohio, AF Materials Lab., Sep. 1963 78 p refs
(Contract AF 33(616)-8483)
(ASD-TDR-63-496; AD-422466)

Elastomeric and plastic O-ring seals were exposed to liquid and vapor phases of nitrogen tetroxide, chlorine trifluoride, a 1:1 mixture of hydrazine–unsymmetrical dimethylhydrazine, and 90% hydrogen peroxide under in-use conditions. Materials included polyethylene, Teflon, butyl, ethylene/propylene, Vitons A and B, silicone, and others. To simulate service conditions, O-rings were tested under compression, in closed static systems, in direct contact with test fluid. The rate of fluid loss through the seal was determined directly. Test method and results are described. Polyethylene encapsulated O-rings and metal-clad elastomeric O-rings as seals for nitrogen tetroxide systems are also discussed. Author

N64-16889 Princeton U., N.J. Frick Chemical Lab.
MASTER CURVE OF POLYSTYRENE BY BALL INDENTATION TECHNIQUE
R. B. Taylor and A. V. Tobolsky Feb. 1964 14 p refs
(Contract Nonr-1858(07))
(ONR-TR-RLT-69; AD-430807)

By measuring the shear compliance of polystyrene by a ball indentation method as a function of time at several temperatures, master curves in shear compliance and relaxation were constructed at 100° C. The master curve in relaxation was compared with that obtained by other workers using a combination of torsional creep and stress relaxation. Author

20 MATHEMATICS

Includes calculation methods and theory; computers; data processing; and numerical analysis. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; and 22 Navigation and Guidance.

N64-16191 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
COLLECTED PAPERS OF M. S. YAROV-YAROVOI
M. S. Yarov-Yarovoi (Moscow State U.) 82 p refs Transl. into ENGLISH of eight papers
(MH-TRANSL-326)

CONTENTS:

1. ON THE COMPUTATION OF HIGHER PARTIAL DERIVATIVES OF A COMPOSITE FUNCTION p A/1–15 refs (See N64-16192 08-20)

2. ON THE COMPUTATION OF HIGHER PARTIAL DERIVATIVES OF THE COMPOSITE FUNCTION p B/1–13 refs (See N64-16193 08-20)

3. ON THE EXPANSION OF THE FORCING FUNCTION OF THE NEWTONEAN ATTRACTION OF TWO BODIES p C/1–11 refs (See N64-16194 08-20)

4. ON THE CONVERGENCE IN THE EXPANSION OF THE FORCING FUNCTION OF THE ATTRACTION OF TWO BODIES p D/1–4 refs (See N64-16195 08-20)

5. ON THE RECURRENT RELATIONS FOR THE COMPUTATION OF THE DERIVATIVES OF COMPOSITE FUNCTIONS p E/1–9 refs (See N64-16196 08-20)

6. ON THE INITIAL MEMBERS IN THE EXPANSION OF THE FORCING FUNCTION OF THE ATTRACTION OF TWO BODIES p F/1–8 refs (See N64-16197 08-20)

7. ON THE EXPANSION OF THE FORCING FUNCTION OF THE TWO-BODY-ATTRACTION UNDER CERTAIN SUPPOSITIONS ON THE DISTRIBUTION OF THEIR DENSITY p G/1–8 refs (See N64-16198 08-20)

8. ON THE EXPANSION OF THE FORCING FUNCTION OF THE TWO-BODY-ATTRACTION WITH RESPECT TO THE MOMENTS OF INERTIA FOR THE NON-MAJOR AND NON-CENTRAL AXES OF INERTIA p H/1–10 refs (See N64-16199 08-20)

N64-16192 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.

ON THE COMPUTATION OF HIGHER PARTIAL DERIVATIVES OF A COMPOSITE FUNCTION

M. S. Yarov-Yarovoi *In its* Collected Papers of M. S. Yarov-Yarovoi [1959] p A/1–15 refs Transl. into ENGLISH from Vestn. Mosk. Gos. U., no. 1, 1958 p 87–95 (See N64-16191 08-20)

A general formula is derived for the partial derivatives of a composite function in which the intermediate arguments depend on several fundamental arguments. The statement of the problem is discussed, and auxiliary operators are obtained. The case in which the function z is differentiated only once with respect to each of the fundamental arguments is investigated. The general case is then discussed and is followed by the reduction of the general formula to a form convenient for practical use. C.L.W.

N64-16193 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.

ON THE COMPUTATION OF HIGHER PARTIAL DERIVATIVES OF THE COMPOSITE FUNCTION (SECOND REPORT)

M. S. Yarov-Yarovoi *In its* Collected Papers of M. S. Yarov-Yarovoi [1959] p/B1–13 refs Transl. into ENGLISH from Vestn. Mosk. Gos. U., no. 2, 1958 p 67–75 (See N64-16191 08-20)

Recurrent relations are provided that are necessary for the application of a general formula for the partial derivatives of a composite function, where the intermediate arguments depend on several fundamental arguments. The counting number of the formula's members was also provided. The case of one intermediate variable is considered, and the basic difficulty in the computation of the partial derivatives of the composite function is discussed. The number of integral positive solutions is then found for the equations necessary for the computation of the partial derivatives of the composite function. C.L.W.

N64-16194 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Regulator Dept.

ON THE EXPANSION OF THE FORCING FUNCTION OF THE NEWTONIAN ATTRACTION OF TWO BODIES

M. S. Yarov-Yarovoi *In its* Collected Papers of M. S. Yarov-Yarovoi [1959] p C/1–11 refs Transl. into ENGLISH from Vestn. Mosk. Gos. U., no. 5, 1958 p 55–61 (See N64-16191 08-20)

Investigations are conducted on the motion of interattracting bodies of an arbitrary form with arbitrarily distributed densities, as well as when both bodies are sufficiently remote from each other. The problem is solved from the explicit expression of the forcing function of the attraction of two bodies through the coordinates of their inertia centers and Euler angles. C.L.W.

N64-16195 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.

ON THE CONVERGENCE IN THE EXPANSION OF THE FORCING FUNCTION OF THE ATTRACTION OF TWO BODIES

M. S. Yarov-Yarovoi *In its* Collected Papers of M. S. Yarov-Yarovoi [1959] p D/1–4 refs Transl. into ENGLISH from Vestn. Mosk. Gos. U., no. 5, 1958 p 63–65 (N64-16191 08-20)

This discussion concerns an expansion representing the forcing function of the attraction of two bodies with respect to their moments of inertia. The necessary and sufficient conditions are provided for the convergence of the expansion. It is proved that the expansion converges absolutely with certain conditions. C.L.W.

N64-16196 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.

ON THE RECURRENT RELATIONS FOR THE COMPUTATION OF THE DERIVATIVES OF COMPOSITE FUNCTIONS

M. S. Yarov-Yarovoi *In its* Collected Papers of M.S. Yarov-Yarovoi [1959] p E/1–9 refs Transl. into ENGLISH from Vestn. Mosk. Gos. U., Astron. no. 6, 1958 p 31–37 (See N64-16191 08-20)

This discussion concerns the derivation of recurrent relations. Study was undertaken to derive a recurrent relation, adequate for the computation of coefficients for derivatives of a composite function, with respect to intermediate arguments in the expression for the partial derivatives of the composite function relative to the fundamental arguments. In order to explain the necessity for the derivation of the recurrent formula, the formula is derived for the case when there is only one fundamental argument t and one intermediate argument x. C.L.W.

N64-16197 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.

ON THE INITIAL MEMBERS IN THE EXPANSION OF THE FORCING FUNCTION OF THE ATTRACTION OF TWO BODIES

M. S. Yarov-Yarovoi *In its* Collected Papers of M. S. Yarov-Yarovoi [1959] F/1–8 refs Transl. into ENGLISH from Vestn. Mosk. Gos. U., no. 6, 1958 p 39–44 (See N64-16191 08-20)

An investigation was conducted of the initial members of the expansion of the recurrent relations, for the computation of the coefficients of the forcing function of the attraction of two bodies. C.L.W.

N64-16198 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.

ON THE EXPANSION OF THE FORCING FUNCTION OF THE TWO-BODY-ATTRACTION UNDER CERTAIN SUPPOSITIONS ON THE DISTRIBUTION OF THEIR DENSITY

M. S. Yarov-Yarovoi *In its* Collected Papers of M. S. Yarov-Yarovoi [1959] p G/1–8 refs Transl. into ENGLISH from Vestn. Mosk. Gos. U., Astron., no. 6, 1959 p 58–63 (See N64-16191 08-20)

This article discusses the expansion of the forcing function of the two-body attraction. This expansion is carried out with respect to the moments of inertia of the bodies, and under certain suppositions on the distribution of their densities.
C.L.W.

N64-16199 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
ON THE EXPANSION OF THE FORCING FUNCTION OF THE TWO-BODY-ATTRACTION WITH RESPECT TO THE MOMENTS OF INERTIA FOR THE NON-MAJOR AND NON-CENTRAL AXES OF INERTIA
M. S. Yarov-Yarovoi *In its* Collected Papers of M. S. Yarov-Yarovoi [1959] p H/1-10 refs Transl. into ENGLISH from Vestn. Mosk. Gos. U., Astron., no. 6, 1959 (See N64-16191 08-20)

Expansion of the forcing function of the two-body attraction is carried out with respect to certain combinations of the moments of inertia. For this purpose, the forcing function of attraction is at first decomposed with respect to the negative degrees of the mutual distances between the fixed points of two bodies. Specifically, it is carried out with respect to the moments of inertia for the nonmajor and noncentral axes of inertia.
C.L.W.

N64-16208 Bayerische Akademie der Wissenschaften, Munich (W. Germany) Deutsche Geodatische Kommission
ADJUSTMENT OF COORDINATES WITH THE ELECTRONIC COMPUTER ZUSE Z-23 [DIE KOORDINATENAUS GLEICHUNG MIT DER ELEKTRONISCHEN RECHENANLAGE ZUSE Z-23]
Gerhard Eichhorn 1963 67 p In GERMAN
(*Its* Series B-Angw. Geod.-96)

Programs are discussed for the adjustment of coordinates on the Zuse Z-23 electronic computer. These programs permit the common adjustment of 13 and 20 new points, respectively. Independent and intensive control possibilities are provided during the calculations, guaranteeing a well-defined solution for the adjustments undertaken. The results of the adjustments are distinctly printed in a DIN-A-4-format in tabulated form. Results obtained from the multipoint adjustment surpass those obtained from single-point adjustment, which indicates an improvement in the accuracy of the point coordinates. I.v.L.

N64-16211 Academia Republicii Populare Romine, Bucharest (Rumania)
A QUALITATIVE THEORY OF DIFFERENTIAL EQUATIONS [TEORIA CALITATIVE A ECUATIILOR DIFERENTIALE]
A. Halanay 1963 482 p refs In RUMANIAN

Liapunov stability theory, structural stability of automatic control systems, oscillation theory, and systems with time delay are described.
P.F.E.

N64-16212 France. Ministère de l'Air, Paris
NUMERICAL CALCULATION AND APPLIED MATHEMATICS COLLOQUIES HELD IN THE CADRE OF THE FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCES CONGRESS (CAEN 1955 – GRENOBLE 1960 – REIMS 1961 – PARIS 1962) [COLLOQUES DE CALCUL NUMERIQUE ET MATHEMATIQUES APPLIQUEES TENUS DANS LE CADRE DES CONGRES DE L'ASSOCIATION FRANCAISE POUR L'AVANCEMENT DES SCIENCES (CAEN 1955 – GRENOBLE 1960 – REIMS 1961 – PARIS 1962)]
Pierre Vernotte ed. Serv. de Doc. Sci. et Tech. de l'Armement, 1963 138 p refs In FRENCH
(*Its* Publ. Sci. et Tech. No. NT-128)

The following topics are discussed: (1) the origin and development of the compact concept; (2) the inverse of a rectangular cracovian and its use in solving linear equation systems; (3) approximations in physics and mathematics; (4) the teaching of mathematics at the Polytechnical Faculty of Mons; (5) the precise determination of the instants of contacts of solar eclipses; (6) the allowable precision of the fixed method of cords in determining the instants of external contacts observed during a solar eclipse; (7) the case of the existence of a characteristic open subgroup in the proximity of any one of a neutral element in a topological group; (8) an approximate calculation of certain very large numbers; (9) some consideration concerning the sequence of prime numbers; (10) the Theory of Magnitudes; and (11) the general properties of equations with partial derivatives.
I.v.L.

N64-16226 Joint Publications Research Service, Washington, D.C.
MATHEMATICAL SOLUTIONS FOR TRANSPORT PROBLEMS
27 Jan. 1964 51 p refs Transl. into ENGLISH of 3 articles from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), v. 3, n. 6, Nov.–Dec. 1963 p 1089–1111 and 1137–1139
(JPRS-22919; OTS-64-21401) OTS: $1.25

CONTENTS:

1. THE TRANSPORT PROBLEM WITH CONTINUOUS DISTRIBUTION OF CONSUMERS B. N. Pshenichnyy p 1–27 refs (See N64-16227 08-20)

2. AN ITERATION METHOD FOR A SOLUTION OF THE TRANSPORT PROBLEM BY MEANS OF A SUPPLEMENTAL LIMITATION, AND AN APPRAISAL OF THE NUMBER OF ITERATIONS Yu. Yu. Finkel'shteyn p 28–43 refs (See N64-16228 08-20)

3. A SOLUTION OF THE TRAVELING-SALESMAN PROBLEM BY INTEGER LINEAR PROGRAMMING V. I. Mudrov p 44–48 ref (See N64-16229 08-20)

N64-16227 Joint Publications Research Service, Washington, D.C.
THE TRANSPORT PROBLEM WITH CONTINUOUS DISTRIBUTION OF CONSUMERS
B. N. Pshenichnyy *In its* Math. Solutions for Transport Probl. 27 Jan. 1964 p 1–27 refs (See N64-16226 08-20) OTS: $1.25

An examination of a method for solving the transport problem, which involves a continuous distribution of consumers along the transport system, is presented. This method is based upon a generalization of the method used for the normal transport problem. Use is made of the equivalence of a system of transport routes to a certain type of graph. A set of apices with a fixed item of production and a set of points of production, with an undetermined amount of product, are delineated. At the remaining apices, the product is demanded. However, the demand occurs not only at the apices but also in the course of the transport of the product along the ribs. At every rib, there is a given density of demand. It is assumed that the graph is orientated and that the calculation is effected from the apex that is the origin of the rib.
I.v.L.

N64-16228 Joint Publications Research Service, Washington, D.C.

AN ITERATION METHOD FOR A SOLUTION OF THE TRANSPORT PROBLEM BY MEANS OF A SUPPLEMENTAL LIMITATION, AND AN APPRAISAL OF THE NUMBER OF ITERATIONS

Yu. Yu. Finkel'shteyn *In its* Math. Solutions for Transport Probl. 27 Jan. 1964 p 28–43 refs (See N64-16226 08-20) OTS: $1.25

The following problem in linear programing is the subject of this report:

$$\sum_{i=1}^{m} k_i \sum_{j=1}^{n} x_{ij} \leq K,$$

$$x_{ij} \geq 0,\ i = 1, 2, \ldots, m, j = 1, 2, \ldots, n,$$

$$\sum_{j=1}^{n} x_{ij} \leq a_i,\ i = 1, 2, \ldots, m,$$

$$\sum_{i=1}^{m} x_{ij} = b_j,\ j = 1, 2, \ldots, n,$$

$$\sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij} = \min.$$

The supplemental linear limitation is: $\sum_{i=1}^{m} a_i > \sum_{j=1}^{n} b_j$, where a_i, b_j, and c_{ij} are positive, k_i is not negative, and at least one of the following is positive $i = 1, 2, \ldots, m$; $j = 1, 2, \ldots, n$. An iterative method is proposed that affords an approximate solution to the problem (with any preassigned degree of accuracy) by means of a repeated application of the algorithm of the transport problem. An a priori estimate is attained from the number of iterations that will guarantee a relative error not in excess of a given magnitude. I.v.L.

N64-16229 Joint Publications Research Service, Washington, D.C.

A SOLUTION OF THE TRAVELING-SALESMAN PROBLEM BY INTEGER LINEAR PROGRAMMING

V. I. Mudrov *In its* Math. Solutions for Transport Probl. 27 Jan. 1964 p 44–48 ref (See N64-16226 08-20) OTS: $1.25

The problem of finding Hamiltonian routes of the shortest length in a full graph is discussed. The problem consists of the following: There are s points and an assigned matrix $|| d_{ij} ||$ of the shortest distances between them. The requirements are to visit all the points by the shortest route, to not visit any one point twice, and to return to the initial point. A new method for solving this problem by reducing it to a problem in linear programing in whole numbers is presented. The method is characterized by fewer input variables than has been used previously. I.v.L.

N64-16252* Martin Co., Baltimore, Md.

DYNAMICAL POLYSYSTEMS AND OPTIMIZATION

D. Bushaw Repr. from Contrib. to Differential Equations [1963] p 351–365

(NASA Contract NASr-103; Contract AF 49(638)-382; Contract Nonr-3693(00); Contract DA-36-034-ORD-3514-Z)

The elements of a new general formalism that seems to hold promise as a device for the analysis of dynamical systems with alternative inputs are described. The basic definitions are given; attention is concentrated on optimization problems and the closely related question of the structure of the boundary of the so-called reachable sets. This line of inquiry culminates in the "generalized Jacobi condition" and its corollary.

Author

N64-16257 System Development Corp., Santa Monica, Calif.

Research Directorate Report [LANGUAGE AND INFORMATION PROCESSING, INFORMATION RETRIEVAL STUDIES AND LINGUISTICS]

L. F. Carter and F. N. Marzocco Jan. 1964 101 p refs (TM-530/007/00)

This report covers discussions on research in artificial intelligence, information retrieval and linguistics, information processing, programing languages, mathematics and operations, systems simulation, decision processes, and education techniques. C.L.W.

N64-16263 Gt. Brit. Ministry of Aviation, Mottingham Technical Information and Library Services

OPTIMISATION OF SYSTEMS CONTAINING ESSENTIALLY NON-LINEAR ELEMENTS [ZADACHA OPTIMIZATSII SISTEM SODERZHASHCHIKH SUSHCHESTVENNO NELINEINYE ELEMENTY]

E. P. Merkulova Jan. 1964 16 p refs Transl. into ENGLISH from Avtomat. i Telemekh (Moscow), v. 20, no. 10, 1959 p 1335–1344

(TIL/T.5464)

A method is described for obtaining the optimum weight function of the linear portion of the steady systems that contains an arbitrary number of nonlinear elements. The problem is solved for various connections of linear and nonlinear parts. The input signal is a random stationary time function of signal and noise. Linearization is achieved by statistical methods.

Author

N64-16304 International Meteorological Centre, Bombay (India)

COMPUTER PLANS

F. R. Miller, M. V. Sivaramakrishnan, and R. Suryanarayana *In its* Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 30–41 refs (See N64-16301 08-21)

Computer facilities and training programs at the International Meteorological Centre are outlined, and two computer programs that are being developed are discussed: (1) data processing of ship's weather reports and (2) radiosonde data processing. P.V.E.

N64-16355 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

GRAPHO-TAPE METHOD OF CONSTRUCTION OF CONTACT

V. N. Roginski 12 Jul. 1963 24 p refs Transl. into ENGLISH from a Russian book "Problemy Peredachi Informatsii" Moscow, Akad. Nauk SSSR, v. 6, 1960 p 34–45

(FTD-TT-63-59/1+2; AD-412892)

An algorithm is proposed that guarantees the construction of the scheme of contact poles (l.k) with straight deductions and without false circuits. The algorithm utilizes detours. Models for operations of the proposed algorithmic method can be made by schemes with series of impulses, and the method can be put into the base of a machine, on contactless elements, for the synthesis of relay schemes. I.v.L.

N64-16359 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

EXCEPTIONAL CASES OF INTEGRAL EQUATIONS OF THE CONVOLUTION TYPE AND EQUATIONS OF THE FIRST KIND

F. D. Gakhov and V. I. Smagina 29 May 1963 45 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Mat. (Moscow), v. 26, no. 3, 1962 p 361–390
(FTD-TT-63-181/1+2+4; AD-409423)

Integral equations with difference kernels for cases in which the coefficient of the corresponding Riemann boundary-value problem reverts to zero or to an infinity of an integral order are investigated. Equations of the first kind are studied, in particular, in which the Riemann-problem coefficient has a zero or a pole at the point at infinity. Author

N64-16416 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BINARY PARALLEL SUMMATOR WITH THROUGH TRANSFER
L. P. Afinogenov and V. G. Kolosov 25 Mar. 1963 5 p Transl. into ENGLISH from Russ. Pat. 142818 (642726/26, Jan. 1960), 1960 p 1–3
(FTD-TT-63-175/1+2; AD-402599)

A binary parallel summator with through transfer is described. The summator utilizes the impedance principle of ferrites. It consists of paraphase ferrite registers, census bus-bars, and a compensation bus-bar. The compensation bus-bar insures the census of units and the ferrite needed with a simultaneous notation of zero in the remaining (nonworking ferrites). The summator described insures addition and subtraction of two binary digits simultaneously in all places. I.v.L.

N64-16431 International Business Machines Corp., Yorktown Heights, N.Y. Thomas J. Watson Research Center
THE LOGIC DESIGN OF ADAM, A PROBLEM-ORIENTED SYMBOL PROCESSOR Final Report
R. F. Schauer and A. P. Mullery 19 Aug. 1963 364 p
(Contract AF 19(628)-1621)
(AFCRL-63-510; AD-428316)

This report presents a general description of the language and a detailed design of a machine organization having the following characteristics: complete symbolic addressing on variable field length data; list and string operations; high-to-low-order numeric processing; dynamic storage allocation; and automatic input/output. The design is described in terms of the algorithms used to implement the machine function, or in the logic itself, where the former approach was not appropriate. A programing manual is presented as Appendix I. The logical design of the complete system is contained in Appendix II. Author

N64-16432 International Business Machines Corp., Yorktown Heights, N.Y. Thomas J. Watson Research Center
THE LOGIC DESIGN OF ADAM, A PROBLEM-ORIENTED SYMBOL PROCESSOR PROGRAMMING MANUAL, APPENDIX I Final Report
R. F. Schauer and A. P. Mullery 19 Aug. 1963 86 p
(Contract AF 19(628)-1621)
(AFCRL-63-510; AD-428726)

This manual presents the coding techniques that will be used to prepare problems for solution on ADAM, an experimental digital data handling system, designed by IBM. The following are discussed: (1) the language and its syntax; (2) the arrangement, structure, and naming of data; (3) reference data; (4) verbs that change the arrangement, structure, and name of data; (5) arithmetic verbs and modifiers; (6) Boolean verbs; (7) set theory verbs; (8) sequencing instructions and tests; (9) other verbs and modifiers; (10) input–output; (11) subroutines; (12) error indications; and (13) efficient programing. R.T.K.

N64-16433 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio Behavioral Science Lab.
ERROR PROTECTED NAMES
Walter J. Huebner, Jr. Dec. 1963 22 p refs
(AMRL-TDR-63-83; AD-430714) OTS: $0.75

A method of generating error-protected encoded information or error-protected names has been originated. Any single name resulting from the application of this system is unique in that at least two of its symbols differ from the symbols in corresponding positions of every other name. This property permits the detection of all errors involving single substitution or erroneous interchange of two symbols. In addition, this system will detect well over 97% of all other errors that might occur in transcribing a name. Name lists generated by the method described are particularly applicable to identification numbers, license plates, parts lists, etc., where mistaken identification is likely to be costly. A list of 961 three-symbol, error protected names is presented. Also presented is a table showing the number of error-protected names that can be generated with selected combinations of namelength and number of usable symbols. Author

N64-16439 Melpar Inc., Falls Church, Va.
SPEECH PROCESSING STUDIES (VOICE DATA PROCESSING SYSTEM) Final Report, Sep. 1961–Sep. 1963
H. A. Straight and O. C. King Oct. 1963 79 p
(Contract AF 19(628)-214)
(AFCRL-63-544; AD-430461)

The Voice Data Processing System was designed and developed to support research on digital voice communication and evaluation of a speech bandwidth compression technique. Significant changes that occurred in this final period are the method of recording input amplitude, greater selectivity in pattern coding, expanded keyboard capability, and increased reliability in compiling speech statistics. Included in the report are a definition of terms and the system operating instructions. Author

N64-16505 Michigan U., Ann Arbor Coll. of Literature, Science, and the Arts
NOTES ON MATHEMATICAL AUTOMATA THEORY Technical Note
J. W. Thatcher Dec. 1963 35 p refs
(Contract Nonr-1224(21); Contract DA-31-124-ARO(D)-G433)
(AROD-4049-3; AD-430106)

A k-monadic algebra is defined to be an abstract algebra $a=\langle A, a_0, \alpha_1, \alpha_k \rangle$ with one distinguished element and k monadic operators. A pure monadic algebra has no distinguished element. The author presents some of the basic concepts and results of finite automata theory within the framework of monadic algebras. Some of the advantages of using abstract algebras for the study of automata are noted. Author

N64-16597 Naval Postgraduate School, Monterey, Calif.
MITROVIC'S METHOD – SOME FUNDAMENTAL TECHNIQUES
George J. Thaler and Toyomi Ohta Jan. 1964 94 p refs
(*Its* Res. Paper No. 39; AD-431900)

Although there are many methods for evaluating the roots of a polynomial, called the "characteristic equation," few of these methods are of significant advantage in engineering synthesis problems. Mitrovic's method, because it relates the root values to coefficient values in a convenient graphical representation, provides a very useful approach to design.

Included in this report are: (1) a review of Mitrovic's method; (2) a generalized expression, in symbolic form, for the Mitrovic curves in terms of any two selected coefficients obtained by Siljak through a formal derivation and rigorous proof; (3) the derivation of a stability criterion based only on the curve of $B_m - B_n$ on the real two-dimensional plane; (4) procedures for sketching the Mitrovic curves; (5) a computer program for printing out the calculated values of any pair of B_ξ and B_m, and for making a graphical plot of this pair on section papers for each values of ξ; and (6) a procedure for compensation design (cascade compensation). I.v.L.

N64-16618 Wisconsin U., Madison Mathematics Research Center

REMAINDERS FOR CONTINUED FRACTIONS

T. L. Hayden Nov. 1963 14 p refs

(Contract DA-11-022-ORD-2059)

(MRC-429; AD-430847) OTS: $1.60

The problem of whether or not a function is equal to its formal continued fraction expansion is studied. This question is answered in terms of the convergence of the continued fraction and the relation of the region that contains the remainders of the continued fraction and the region that contains the quantities B_n/B_{n-1}, where B_n is the denominator of the n^{th} approximate to the continued fraction. The problem of uniform convergence of the continued fraction is avoided. Author

N64-16619 Wisconsin U., Madison Mathematics Research Center

RELATIONS BETWEEN PERIODS AND AMPLITUDES OF PERIODIC SOLUTIONS OF $x + g(x) = 0$

Minoru Urabe Nov. 1963 49 p refs

(Contract DA-11-022-ORD-2059)

(MRC-437; AD-430764) OTS: $4.60

The period of the periodic motion described by the equation in the title varies with its amplitude of velocity. The problem studied in the present report is to find the relations between the period and the amplitude or the amplitude of velocity in such a form that, from these relations, it is possible to determine the function g(x) that yields periodic motions whose period may vary in the arbitrary prescribed way with the amplitude or the amplitude of velocity. The half-periods and the half-amplitudes are also brought into question. In illustration, the function g(x) is computed, which yields periodic motions whose period may vary linearly with the amplitude. Author

N64-16620 Wisconsin U., Madison Mathematics Research Center

A CHARACTERIZATION OF Δ_2— PREDICATES

Bruno Scarpellini Nov. 1963 21 p refs

(Contract DA-11-022-ORD-2059)

(MRC-439; AD-430763) OTS: $2.60

A Δ_2-predicate is a number-theoretic predicate that is expressible in both two-quantifier forms. More generally, a set m is called a Δ_2-set if it is constructible and if Od^1 m is isomorphic to a well-ordering of natural numbers that is a Δ_2-predicate. A finite set S of formulas without free variables is called a system of axioms if the formulas contain only the two predicate variables ϵ_1 and = (the latter are called formulas of set theory). A set m is a model of S if the formulas obtain the value "true," when the quantifiers run over elements of m, and ϵ and = are replaced by ϵ and =, respectively. m_0 is a Δ_2-set if there exists a finite system of axioms S, with the properties (1) S has exactly one transitive Model m, (2) m is denumerable and $m_0 \epsilon$ m. Another characterization of Δ_2-sets is obtaind by giving a class K of functions defined by transfinite induction such that (1) for $f \epsilon K$ every x belonging to the range of f is a Δ_2-set, (2) corresponding to every Δ_2-set x there is an f in K whose range contains x. Author

N64-16622 Wisconsin U., Madison Mathematics Research Center

NOTES ON THE SCHROEDINGER OPERATOR

Robert Ryan Jan. 1963 21 p refs

(Contract DA-11-022-ORD-2059)

(MRC-441; AD-430762) OTS: $2.60

This paper presents several facts about the Schroedinger operator $-\Delta + q(x)$ where Δ denotes the three-dimensional Laplacian and q is a real-valued potential function defined in three-dimensional Euclidean space satisfying the assumption that q is measurable and square integrable on every compact subset of $E = E^3$, and there exist positive constants R_0, C_0, and ϵ such that $|q(x)| \leq C_0 |x|^{-1-\epsilon}$ for all $|x| \geq R_0$. E.W.

N64-16623 Wisconsin U., Madison Mathematics Research Center

A CONDITION NECESSARY AND SUFFICIENT FOR A FUNCTION TO BE EQUAL TO ITS CONTINUED FRACTION EXPANSION. APPENDIX: THE EFFECT OF REMAINDERS ON CONVERGENCE

Ralph E. Lane and T. L. Hayden Nov. 1963 27 p refs

(Contract DA-11-022-ORD-2059)

(MRC-423; AD-430761)

The problem of whether or not a continued fraction expansion for a specified function is equal to that function is solved in terms of the remainders of the expansion. As an example, a method of expanding $\int_0^x e^{-t^2/2} dt$ into a continued fraction is given. A method of obtaining approximations of specified accuracy is also given. In the appendix, various expansions are obtained for the remainders of the example, and the effect of these remainders on the rate of convergence is considered. Author

N64-16652 RAND Corp., Santa Monica, Calif.

ON COMPUTATIONAL APPROACHES TO SOME MATHEMATICAL MODELS OF TURBULENCE

S. P. Azen, R. Bellman, and J. M. Richardson Jan. 1964 20 p refs

(ARPA Order 189-61; ARPA-SD-79)

(RM-3819-ARPA; AD-431521)

Computational methods to the solution of the model equation of Burgers are investigated. The application of a classical method of converting a partial differential equation into an infinite system of ordinary differential equations is studied. Numerical results obtained from a FORTRAN program are given. Author

N64-16666 Oak Ridge National Lab., Tenn.

MATHEMATICS DIVISION ANNUAL PROGRESS REPORT, PERIOD ENDING DECEMBER 31, 1963

A. S. Householder and A. C. Downing Mar. 1964 57 p refs

(Contract W-7405-ENG-26; NASw-6550)

(ORNL-3567) OTS: $1.50

A summary is presented of activities in the following areas: (1) mathematical research—programing research and computing services; and (2) mathematical statistics—statistical research, applications, and programing. P.V.E.

N64-16676* Martin Co., Baltimore, Md. RIAS Div.
LINEAR FUNCTIONAL-DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS
Jack K. Hale [1963] Repr. from Contrib. to Differential Equations p 291–317 refs
(NASA Contract NASr-103; Contract AF 49(638)-382; Contract Nonr-3693(00))

An attempt is made to obtain some analogies between linear differential-difference equations with constant coefficients and ordinary linear differential equations with constant coefficients. The eigenspaces of the linear equation are discussed in detail, and then use is made of the adjoint equation to introduce new coordinates in the function space that exhibit in a natural manner the behavior of solutions on an eigenspace and the behavior of solutions on a complementary space. This approach is intended to lead to a better understanding of much of the geometric theory of differential-difference equations. R.T.K.

N64-16683* New York U., N.Y.
TWO NEW CLASSES OF ALGORITHMS FOR FINDING THE EIGENVALUES AND EIGENVECTORS OF REAL SYMMETRIC MATRICES
C. Donald La Budde Repr. from J. Assoc. Computing Machinery, v. 11, no. 1, Jan. 1964 p 53–58 refs
(NASA Grant NsG-76-60)

The algorithms described in this paper are essentially Jacobi-like iterative procedures employing Householder orthogonal similarity transformations and Jacobi orthogonal similarity transformations to reduce a real symmetrix matrix to diagonal form. The convergence of the first class of algorithms depends upon the fact that the algebraic value of one diagonal element is increased at each step in the iteration, and the convergence of the second class of algorithms depends upon the fact that the absolute value of one off-diagonal element is increased at each step in the iteration. Then it is shown how it is possible to combine one algorithm from each class together into a "mixed" strategy for diagonalizing a real symmetric matrix. Author

N64-16695 Oak Ridge National Lab., Tenn. Electronuclear Div.
A FORTRAN PROGRAM FOR ESTIMATING RESIDUAL RADIATION LEVELS IN HIGH-ENERGY CHARGED-PARTICLE ACCELERATORS
J. B. Ball and C. B. Fulmer Mar. 1964 15 p refs
(Contract W-7405-eng-26)
(ORNL-3554) OTS: $0.50

A FORTRAN II program is described for utilizing cross section data for spallation products to obtain an estimate of the residual radiation from the bombardment of materials with high-energy particles. Author

N64-16735* International Business Machines Corp., Poughkeepsie, N.Y.
ASAP, AN AUTOMATED STATISTICAL ANALYSIS PROGRAM Part One [of] Two-Part Final Report
[1963] 45 p refs
(NASA Contract NAS5-3373)
(NASA CR-55835) OTS: $4.60 ph, $1.55 mf

In contrast to previous programs, ASAP does not require that the circuit equations be written and solved to produce a Monte Carlo statistical analysis. By using a nodal description of the circuit in an English text, free-format input style, ASAP will write the circuit equations, solve them algebraically, write and compile a FORTRAN subroutine, and run the statistical analysis. A detailed description of each of these steps is presented. A considerable amount of programer time can be saved and careless errors can be eliminated by this method. Author

N64-16753* Maryland U., College Park Computer Science Center
MOIST: MACRO OUTPUT INPUT SYSTEM FOR THE IBM 7090
Gerald M. Berns (IBM) Jan. 1964 48 p
(NASA Grant NsG-398)
(NASA CR-53080; TR-64-5) OTS: $4.60 ph, $1.64 mf

This report describes the Macro Output–Input System, a programing package for the IBM 7090 designed to make the tasks of reading input and writing output as easy to program as simple addition and subtraction. The advantage and capabilities of the system are described, along with numerous examples illustrating its use. Author

N64-16778 Stanford U., Calif.
ESTIMATION OF THE COVARIANCE AND AUTOREGRESSIVE STRUCTURE OF A STATIONARY TIME SERIES Technical Report No. 12
M. Casini Schaerf 13 Jan. 1964 74 p refs
(Contract DA-ARO(D)-31-124-G363)
(AROD 2025-12; AD-432148) OTS: $7.60

This work deals with the following problem: given a finite length of record from a discrete-parameter normal-covariance stationary time series with zero mean [X(t), t = 0, ±1, ...], estimate the covariance function and other quantities related to it, like the autoregression coefficients. There are three parts: estimation of the covariance function, estimation of the autoregressive structure, and applications to the sunspot series. Author

N64-16790 RAND Corp., Santa Monica, Calif.
SINGULAR SOLUTIONS OF AN INTEGRO-DIFFERENTIAL EQUATION IN RADIATIVE TRANSFER
T. W. Mullikin Apr. 1963 24 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3575-PR; AD-402496)

In the theory of radiative transfer in a homogeneous isotropic slab of thickness τ, the scattering (reflection) function can be determined by a nonlinear integro-differential equation and initial conditions. For a numerical analysis of this equation, it is often important to know the behavior of solutions in the vicinity of the desired solution. In this report, conservative and isotropic scattering is extended to the nonconservative case. A set of initial conditions is exhibited for which the solutions to the nonlinear integro-differential equation are infinite for finite values of the parameter τ. Some of these singular solutions first come close to the desired solution and then diverge to infinity. The nearness of approach of these singular solutions is proportional to a quantity that measures the nearness of local scattering to the conservative case. The conservative case is again found by a continuous passage from nonconservative to conservative scattering. Author

N64-16798 Aerospace Medical Div. Aerospace Med. Research Labs. (6570th), Wright-Patterson AFB, Ohio Behavioral Sciences Lab.
STUDIES IN RESEARCH METHODOLOGY. V. IRRELEVANCE IN THE t TEST'S REJECTION REGION

James V. Bradley Dec. 1963 47 p refs
(AMRL-TDR-63-109; AD-431210) OTS: $1.25

This report shows that the proportion of irrelevant t's in the t test's rejection region diminishes with increasing sample size and is inversely related to the size, α, of the significance level used. Irrelevance virtually disappears at very large sample sizes; however, it is quite appreciable at the sample sizes commonly used in psychological experiments. Author

N64-16816 Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
THE SOLUTION OF ALGEBRAIC EQUATIONS BY ROOT FINDING TABLES. PART I-INSTRUCTIONS
Kurt H. Haase Dec. 1963 85 p refs
(AFCRL-63-559(1); AD-428084)

A polynomial of odd degree can be factored as a product of one of three linear polynomial factors and a residue factor that is a polynomial of even degree. A polynomial of even degree can be factored as a product of two or four linear polynomial factors and a residue polynomial of even degree. The linear polynomial factors can easily be recognized by scanning through a power table; and they can be improved to any desired degree of accuracy and eliminated by the Horner method. A residue polynomial or a polynomial of even degree with no recognizable linear polynomial factors can be factored in a number of quadratic polynomial factors equal to half the degree of the polynomial. The coefficients of the quadratic polynomial factors can be recognized by scanning through a polynomial table; they can be improved to any degree of accuracy by the Collatz method. Author

N64-16817 Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
THE SOLUTION OF ALGEBRAIC EQUATIONS BY ROOT FINDING TABLES. PART II—POWER TABLE AND POLYNOMIAL TABLES
Kurt H. Haase Dec. 1963 119 p
(AFCRL-63-559(2); AD-428090)

This report contains two numerical tables referred to as Power Table and Polynomial Tables. The first one tabulates n^i in the ranges $0 \leq n \leq 2.00$ in steps of 0.01 and $1 \leq i \leq 12$ in steps of 1.00. The Polynomial Tables contain Table 0 in which polynomial $Z_{0k}(x,y)$, and Table 1 in which polynomials $Z_{1k}(x,y)$ are tabulated. The variables range in $0 \leq x \leq 1.00$ and $0 \leq y \leq 2.00$ with a step increase of 0.05. The Power Table is provided for the evaluation of polynomials at real values of the variable. The Polynomial Tables are provided for finding a quadratic polynomial factor of a polynomial. Author

N64-16818 Parke Mathematical Labs., Inc., Carlisle, Mass.
A MATHEMATICAL MODEL FOR INPUT-OUTPUT DEVICES AND THEIR CONNECTIONS Scientific Report No. 5
L. Calabi and J. A. Riley Nov. 1963 62 p refs
(Contract AF 19(628)-2417)
(AFCRL-64-4; AD-430819)

As discussed in this report, a device consists essentially of inputs, outputs, and transfer functions. Electrical switches and their connection in series and in parallel are discussed. Using relays, the notion of "control connection," which is basic in the theory of gate networks, is exemplified. Series and control connections are two examples of substitution operations. Contraction and evaluation operations are also introduced and illustrated within the familiar context of the boolean switching theory. A multiple output device is built by contracting inputs of different devices, and it is shown how output "fan out" may be realized by input contraction. The axiomatic theory of devices is started with a preliminary study of operations on finite sequences; "substitution algebra" is then introduced. A set of elements (functions, devices, etc.) is designated on which the substitution, contraction, and evaluation operations are defined. The formal introduction of these notions is extended to obtain the general concept of substitution algebra of devices. The transfer function is defined by using the evaluation operations. Finally, the detailed development of substitution algebras is initiated by introducing the notions of subalgebra, a generating set, homomorphism, and completeness. I.v.L.

N64-16819 Lincoln Lab., Mass. Inst. of Tech., Lexington
AN INTRODUCTION TO ESTIMATION THEORY FOR DYNAMICAL SYSTEMS
Fred C. Schweppe 28 Aug. 1963 51 p refs
(Contract AF 19(628)-500)
(Rept. 22G-15; AD-417777)

Estimation (filtering) theory for dynamical systems is reviewed. Emphasis is on time-varying systems and nonstationary stochastic processes. The basic ideas for linear systems are presented in an intuitive manner using time-domain techniques and the state-variable concept. Both continuous and discrete time systems are discussed. A control problem and the principle of least-squares curve fitting are related to the basic estimation problem. In addition to the presentation of fundamental principles for linear systems, brief discussions on a wide variety of related subjects are included in an appendix. Author

N64-16824 DODCO Inc., Blawenburg, N.J.
THE LITTON FLIGHT DATA COMPUTER AS A RE-ENTRY CONTROL DIRECTOR Engineering Report
Daniel O. Dommasch and Charles W. Laudeman Woodland Hills, Calif., Litton Systems Inc., Nov. 1963 140 p refs Prepared under subcontract with Litton
(SMFD-2-6; Suppl. to ASD-TDR-63-760; AD-429157)

This report summarizes the results of the investigations carried out involving utilization of the DOLIAC logic and associated systems for programing the Litton FDC. The object of the program is to provide safe reentry and landing of advanced flight vehicles. R.T.K.

N64-16825 Electronic Systems Div., Bedford, Mass.
ADVANCED LANGUAGE PROCESSING PROCEDURES
S. J. Keyser Sep. 1963 24 p refs
(ESD-TDR-63-620; AD-430608)

In the past computer query languages have taken the form of artificial, quasi-English languages that bear slight resemblance to ordinary English but which are sufficiently simple syntactically and sufficiently mnemonic lexically that the user can master them with less difficulty than the more specialized languages associated with computer technology. The purpose of this paper is to outline a recent theoretical advance in the science of linguistics that renders possible the use of natural English as a query language in computer-based systems. The advantages of this approach are considered. Author

N64-16835 Wisconsin U., Madison Mathematics Research Center
ON WAVE FRONTS AND BOUNDARY WAVES Technical Summary Report

G. F. D. Duff Nov. 1963 70 p refs
(Contract DA-11-022-ORD-2059; NSF Grant 16836)
(MRC-434; AD-431098) OTS: $7.60

For a scalar field governed by a linear, hyperbolic, partial differential equation with constant coefficients, the wave fronts and their singularities arising from a point source in space–time are studied. The calculus of distributions is employed to represent the elementary solution, and a method of stationary phase is used to describe asymptotically its singularities. The occurrence of coincident characteristic roots, giving rise to ruled surface singularities, is considered. The reflection of the waves at a plane boundary, where several further types of waves can arise is discussed. Head waves and branch waves arise from branch points associated with real and complex normal roots. The Rayleigh and supersonic waves arise from poles of a certain boundary discriminant, and the latter type has an extended domain of dependence. Author

N64-16843 Stanford U., Calif.
ONE-DIMENSIONAL COHOMOLOGY IN DOMAINS OF HOLOMORPHY
Halsey Royden 9 Dec. 1963 10 p ref
(Contract DA-ARO(D)-31-124-G80)
(AROD-1323-29; Tech. Rept. 25; AD-431816) OTS: $1.10

Several theorems on one-dimensional cohomology are presented. The theorems are an extension of another theorem that states that the one-dimensional Cech cohomology with integer coefficients of the maximal ideal space of a commutative Banach algebra is isomorphic to the quotient of the group of invertible elements modulo the subgroup of exponentials. Relative cohomology for polynomially convex domains and the algebra of analytic functions on the domains are discussed. It is shown that the envelope of holomorphy of a domain in the space C^n has vanishing one-dimensional cohomology relative to the domain. P.V.E.

N64-16844 Michigan U., Ann Arbor Communication Sciences Program
THE THEORY OF ALGEBRAIC AUTOMATA I: MORPHISMS AND REGULAR SYSTEMS
Yehoshafat Give'on Jan. 1964 19 p refs
(Contract Nonr-1224(21); Contract DA-31-124-ARO(D)-G433)
(AROD 4049-4; Rept. 05662, 03105-27-T; AD-432146)
OTS: $1.60

This is a preliminary report on a study of an algebraic generalization of the concept of regular events. Among all the possible ways of generalization the one suggested by the characterization of regular events by means of homomorphisms with finite ranges was chosen. Following this suggestion, attention is directed to the study of homomorphisms of monoids and their effect on subsets of monoids. Furthermore, a general algebraic framework is suggested in which several and various domains in the area of automata theory (like finite-state transductions, commutative machines, and context-free languages) can be studied and generalized uniformly. The study of the basic and immediate properties of regular systems in monoids and the effect of homomorphisms on such systems are presented. Author

N64-16863 Northwestern U., Evanston, Ill.
THE DUAL METHOD AND THE METHOD OF BALAS AND IVANESCU FOR THE TRANSPORTATION MODEL
A. Charnes and M. Kirby Dec. 1963 20 p refs
(Contract Nonr-1228(10))
(ONR-RM-86; AD-431537)

The problem of determining the optimal solution for the distribution of a transportation problem, when the quantities available at the origins and required at the destinations are variable, is discussed. An elaborate system of lemmas and theorems that leads to simple procedures for transition from one optimal solution to another, when the amounts available and required are changed so as to make the original solution no longer feasible, is shown to be correct. It is further shown that this method (of lemmas and theorems) is isomorphic with the use of the poly-ω technique and the dual method in solving the distribution problem. The straightforward application of the two ideas, poly-ω technique and dual method, is shown to yield good results that are much more difficult to obtain by using other procedures, such as graph theory. P.V.E.

N64-16864 Northwestern U., Evanston, Ill. Technological Inst.
AN ALGORITHM FOR GENERATING PSEUDO-RANDOM PERMUTATIONS
Rolando Eisen Feb. 1964 4 p
(Contract Nonr-1228(10))
(ONR-RM-93; AD-431536)

An algorithm (suitable for coding on electronic computers) that can be used to generate pseudorandom permutations of any N numbers is presented. A computer code of the algorithm is presented along with an example of its use. P.V.E.

N64-16882 Naval Ordnance Lab., White Oak, Md.
MATHEMATICAL RELATIONS AND NUMERICAL TABLES FOR THE GEOMETRICAL ASPECTS OF DIFFUSION PROPAGATION IN ENCLOSED CHAMBERS
Henry Gerber 18 Dec. 1963 196 p refs
(NOLTR-63-139; AD-430195)

This report presents relations for determining the time-varying, average temperature that results from the diffusion of heat to the walls of a gas-filled enclosure. At infrasonic frequencies, the average temperature is the basic quantity that determines the relationship between dynamic volume and pressure changes. Sinusoidal and step changes are emphasized, and extensive, five-figure, tabulated data are given for the sphere, the infinite narrow box, and a wide range of finite cylinders. Author

N64-16890 Carnegie Inst. of Tech., Pittsburgh, Pa.
SUFFICIENT EXPERIMENTS AND THE OPTIMAL ALLOCATION OF OBSERVATIONS Technical Report No. 10
M. H. De Groot Jan. 1964 42 p refs
(Contract DA-36-061-ORD-447; NSF Grant 25087)
(CIT-ORD-16-TR10; AROD-1280-11; AD-430075)

This report is concerned with the concept of sufficient experiments; in particular, an exploration is made of the relevance of this concept in problems in which a fixed total number of observations must be allocated in some optimal fashion among various possible alternatives. Roughly speaking, an experiment X^* is sufficient for another experiment X if it is possible, from an observation on X^* and an auxiliary randomization, to generate a random variable with the same distribution as X. Author

21 METEOROLOGY

Includes climatology; weather forecasting; and lower atmosphere studies. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N64-16145 Joint Publications Research Service, Washington, D.C.

STUDIES IN METEOROLOGY AND HYDROLOGY

14 Feb. 1964 66 p refs Transl. into ENGLISH of 13 articles from Meteorol. i Gidrol. (Moscow), no. 12, 1963 p 3–21, 31–32, 48–53, and 55–63

(JPRS-23246; OTS-64-21571) OTS: $1.75

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3. USE OF AN ELECTRONIC COMPUTER TO SOLVE THE PROBLEM OF UNSUSTAINED WATER MOTION IN A RESERVOIR B. M. Budak, Ye. A. Vinogradova, V. B. Glasko, G. Ye. Kononkova, and L. V. Poborchaya (Moscow State U.) p 16–25 refs

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5. S. S. GAYGEROV'S "QUESTIONS OF AEROLOGICAL STRUCTURE, CIRCULATION AND CLIMATE OF THE FREE ATMOSPHERE IN THE CENTRAL ARCTIC AND ANTARTIC" G. M. Tauber p 30–32 (See N64-16148 08-21)

6. STUDYING THE ATMOSPHERIC BOUNDARY LAYER FROM A 300-METER METEOROLOGICAL TOWER (COLLECTION) A. Kh. Khrgian p 33–34 (See N64-16149 08-21)

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N64-16146 Joint Publications Research Service, Washington, D.C.

SOME CIRCULATORY FEATURES IN THE TROPOSPHERE AND IN THE STRATOSPHERE NEAR THE EQUATOR

V. R. Bubentsov *In its* Studies in Meterorol. and Hydrol. 14 Feb. 1964 p 1–6 refs (See N64-16145 08-21) OTS: $1.75

Regularities in the distribution of air currents in the troposphere and stratosphere in the near-equatorial zone (of the Pacific Ocean) are discussed. At the earth's surface and in the lower 6- to 8-km depth, rarely in the upper troposphere or lower stratosphere, there prevails a steady easterly flow. Against this easterly flow there will appear, but seldom, currents having a western component. Above this lower easterly current, there occurs a westerly flow, the vertical depth of which can vary appreciably from 8 to 18 km and more and is of a prevailing nature. If there are any perturbations in the distributions of these air currents, they are brief, do not encompass layers of great depth, and quickly become absorbed by the general flow. In general, it can be considered that, in the equatorial region, a two-layered distribution of currents predominates for heights of from 20 to 24 km. When heights up to 30 km are considered, a three-layered and, at times, a four-layered distribution are found. P.V.E.

N64-16147 Joint Publications Research Service, Washington, D.C.

MECHANISM OF CONDENSATION PROCESSES IN THE ATMOSPHERE

L. Krystanov and G. Miloshev *In its* Studies in Meteorol. and Hydrol. 14 Feb. 1964 p 7–15 (See N64-16145 08-21) OTS: $1.75

A formula is derived for determining the energy used in the atmospheric process of nucleation. P.V.E.

N64-16148 Joint Publications Research Service, Washington, D.C.

S. S. GAYGEROV'S "QUESTIONS OF AEROLOGICAL STRUCTURE, CIRCULATION AND CLIMATE OF THE FREE ATMOSPHERE IN THE CENTRAL ARCTIC AND ANTARCTIC"

G. M. Tauber *In its* Studies in Meteorol. and Hydrol. 14 Feb. 1964 p 30–32 (See N64-16145 08-21) OTS: $1.75

A review is presented of a book by S. S. Gaygerov that is concerned with the atmospheric processes and climates of the polar regions. P.V.E.

N64-16149 Joint Publications Research Service, Washington, D.C.

STUDYING THE ATMOSPHERIC BOUNDARY LAYER FROM A 300-METER METEOROLOGICAL TOWER (COLLECTION)

A. Kh. Khrgian *In its* Studies in Meteorol. and Hydrol. 14 Feb. 1964 p 33–34 Review of book ed. by A. A. Dmitriyev and N. L. Byzova (See N64-16145 08-21) OTS: $1.75

A review is presented of a book dealing with observations taken from a 310-m meteorological tower. P.V.E.

N64-16301 International Meteorological Centre, Bombay (India)

PRELIMINARY RESULTS AND FUTURE PLANS OF THE INTERNATIONAL INDIAN OCEAN EXPEDITION METEOROLOGY PROGRAMME

Oct. 1963 118 p refs Presented at a seminar held in Bombay, 1 Aug. 1963

(Sponsored by NSF, India Meteorol. Dept. and USIS)

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4. CENTRAL INDIAN AND PENINSULA THUNDERSTORMS DURING THE PREMONSOON SEASON V. Srinivasan and M. B. Mathur (IMC) p 42–56 refs (See N64-16305 08-21)

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7. THE SEA BREEZE AT AND NEAR BOMBAY C. M. Dixit and J. R. Nicholson (IMC) p 82–93 refs (See N64-16308 08-21)

8. INTERACTIONS BETWEEN MONSOON CURRENT AND WATER SURFACE OVER THE ARABIAN SEA J. A. Colon (IMC) p 94–103 refs (See N64-16309 08-21)

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10. MONSOON DEFINITIONS C. R. V. Raman (IMC) p 111–115 ref (See N64-16311 08-21)

N64-16302 International Indian Ocean Expedition

INTRODUCTION: [RELATIONS AMONG WEATHER, WINDS AND PRESSURES IN LOW LATITUDES]

C. S. Ramage *In* Intern. Meteorol. Centre Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 5–12 refs (See N64-16301 08-21)

The problems associated with low-latitude weather analysis are discussed, along with the relative merits of pressure and kinematic analysis techniques. It is concluded that radar methods of measuring upper winds are accurate enough that a sufficiently dense network of radar stations in low latitudes might provide data adequate for meteorologists to compute large-scale vertical motions and then relate them quantitatively to the simultaneous weather distribution. P.V.E.

N64-16303 International Meteorological Centre, Bombay (India)

UPPER AIR CLIMATOLOGY

C. R. V. Raman *In its* Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 13–29 refs (See N64-16301 08-21)

A set of mean resultant upper wind charts for the midseason months January, April, July, and October at the standard isobaric levels 850 mb through 200 mb is presented. Salient features of circulation patterns are discussed, with reference to subtropical anticyclones, low latitude and equatorial configurations, the trades, and the westerlies. Reference is made to the significantly large displacement of the subtropical ridge line over the Indian subcontinent during summer. The existence of near-equatorial circulations in the lower troposphere and their influence on the Indian summer monsoon are mentioned. Author

N64-16305 International Meteorological Centre, Bombay (India)

CENTRAL INDIAN AND PENINSULA THUNDERSTORMS DURING THE PREMONSOON SEASON

V. Srinivasan and M. B. Mathur *In its* Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 42–56 refs (See N64-16301 08-21)

A comparison of thunderstorm activity over central India and the peninsula section of India over a number of years is discussed. The comparison indicated that there are marked changes in the general circulation characteristics from year to year, and that these changes have significant effects on the weather over India, taking the season as a whole. P.V.E.

N64-16306 International Meteorological Centre, Bombay (India)

SYNOPTIC OSCILLATIONS OF ARABIAN ANTICYCLONES IN THE TRANSITION SEASON

K. M. Ramamurthi and R. N. Keshavamurthy *In its* Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 57–67 refs (See N64-16301 08-21)

An investigation into the significant features that characterize the end of the transition period and the beginning of the monsoon regime over India is discussed. Preliminary results of the investigation indicate that: (1) During the period May to June, when an extensive subtropical anticyclone at 300 and 500 mb becomes located over West Pakistan and the adjoining areas, and when a trough extends eastward from the southeast Arabian Sea, the changeover from the transition period to the southwest monsoon season is taking place over India. (2) Due to the close association between oscillations of the anticyclone and passage of low latitude troughs in the westerlies, a careful analysis of the intensity and changes of circulation index and a careful tracking of the Arabian Sea subtropical anticyclone from April onward may be helpful for medium range forecasting of the onset of the southwest monsoon rains over India. P.V.E.

N64-16307 International Meteorological Centre, Bombay (India)

EQUATORWARD EXTENSION OF TROUGHS IN THE UPPER WESTERLIES AND THE RELATION OF UPPER TROPOSPHERIC FLOW TO ONSET OF MONSOON RAINS OVER INDIA

T. S. S. Anjaneyula and D. R. Sikka *In its* Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 68–81 refs (See N64-16301 08-21)

Daily 200 mb streamline charts for the months of March through May occasionally show large equatorward extension of troughs in upper westerlies. The possible effects of the troughs on surface weather during their eastward passage are briefly discussed. The differences between mean circulation over India and neighboring areas during April and May 1963, and the normal April and May circulation are discussed. Mean 200 mb level winds during May 1963 have been studied more critically to show the suddenness of changes in the upper tropospheric circulation pattern during the second half of the month. The mean zonal and meridional components of the winds have been studied to determine possible relationships between the perturbations in westerlies at that level in the transition season and at the onset of the summer monsoon over India. Author

N64-16308 International Meteorological Centre, Bombay (India)

THE SEA BREEZE AT AND NEAR BOMBAY

C. M. Dixit and J. R. Nicholson *In its* Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 82–93 refs (See N64-16301 08-21)

Observational data taken of the sea breeze at and near Bombay are presented, and the theoretical model of sea breeze circulation used in interpreting the data is discussed. P.V.E.

N64-16309 International Meteorological Centre, Bombay (India)

INTERACTIONS BETWEEN MONSOON CURRENT AND WATER SURFACE OVER THE ARABIAN SEA

J. A. Colon *In its* Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 94–103 refs (See N64-16301 08-21)

An investigation to determine the effects, if any, of the water temperatures over the Arabian Sea on the onset and properties of the southwest monsoon current is discussed. Subjects discussed in particular are: the ocean heat balance—heat flux and radiation balance, and heat storage and current transport; and (2) low-level properties of the monsoon current over the Arabian Sea. P.V.E.

N64-16310 International Indian Ocean Expedition
BAY OF BENGAL MONSOON
C. S. Ramage *In* Intern. Meteorol. Centre Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 104–110 refs (See N64-16301 08-21)

A circulation model, which qualitatively appears to fit observations taken of a Bay of Bengal monsoon, is presented. Use of the model may be able to explain the observed distribution of monsoon rain and clouds and the apparent anomaly of variable precipitation falling from what seems to be a uniform layer of nimbostratus. Also, the model indicates that monsoon rain would appear to be associated with low-level divergence, whereas the shower-type precipitation typical of fair weather regimes within the monsoon may be associated with low-level convergence. The monsoon cyclone model depicts a direct circulation system, which, when once established, should persist for some time. P.V.E.

N64-16311 International Meteorological Centre, Bombay (India)
MONSOON DEFINITIONS
C. R. V. Raman *In its* Prelim. Results and Future Plans of the Intern. Indian Ocean Expedition Meteorol. Programme Oct. 1963 p 111–115 ref (See N64-16301 08-21)

Discussed are present concepts of monsoons and their limitations, and the parameters used in defining a monsoon and their application of these parameters. P.V.E.

N64-16341 Thiokol Chemical Corp., Denville, N.J. Reaction Motors Div.
INFLUENCE OF IONS ON ROCKET COMBUSTION Final Report, 1 Mar. 1958-21 Mar. 1963
T. H. Dimmock [1963] 63 p refs
(Contract AF 49(638)-305)
(AFOSR-5493; AD-256015)

The ionization profile along the axis of a seeded, Mach 3, high-altitude rocket exhaust has been mapped by microwave and probe techniques. The ionization density in the jet was as high as 10^{13} electrons/cm^3 and was found to vary half an order of magnitude between expansion and shock regions. The relaxation in the jet was evaluated from the measured data. Since the ionization was found to follow the gas density profile, it was concluded that the relaxation time was at least as long as the transit time between the shock waves, and that the residence time in the shock zone was sufficient to sustain this ionization. Cases in which the residence time is less than the thermalizing time are also illustrated. The thermodynamic properties in the jet were measured by pressure and temperature probes and by line reversal spectroscopy. Author

N64-16376 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINATION OF ATMOSPHERIC TURBIDITY IN VARIOUS DIRECTIONS BY POLARIMETRY
D. G. Stamov 27 Jun. 1963 19 p refs Transl. into ENGLISH from the book "Aktinometriya i Atmosfernaya Optika" Leningrad, Gidrometeorol. Izd., 1961 p 115–124
(FTD-TT-63-536/1+2+4; AD-413084)

Polarimeter and actinometer measurements were made without filters by using a Martens polarimeter and a Michelson actinometer. Polarization was measured at three points on a cloudless sky: the zenith, the celestial pole, and the point of maximum polarization of the solar vertical. The observations were made in the fall of 1958. Almucantar measurements were also made. The distribution of polarization at a given scatter angle is related to atmospheric turbidity by means of a semiempirical formula. R.T.K.

N64-16380 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEVICE FOR MEASURING THE WATER CONTENT OF CLOUDS IN THE DROP-FORMING STATE AND RAINS
I. V. Molokanov 2 Aug. 1963 6 p Transl. into ENGLISH from Russian Patent no. 152106, (746678/26-10), 3 Oct. 1961 p 1–4
(FTD-TT-63-621/1+2; AD-414996)

A device was designed for measuring the water content of drop-forming clouds. The device is in the form of a moisture receiver with a hydroscopic tape that is drawn between the plates of the condenser of a volumetric moisture meter. R.T.K.

N64-16486 Emmanuel Coll., Boston, Mass. Research Language Center
THE MERIDIONAL, AEROLOGICAL CROSS SECTION BETWEEN THE TROPICS OF THE NORTHERN AND SOUTHERN HEMISPHERE [MERIDIONAL'NYI AEROLOGICHESKII RAZREZ MEZHDU TROPIKAMI IUZHNOGO U SEVERNOGO POLUSHARII]
L. A. Zhdanov Bedford, Mass., AFCRL [1963] 9 p Transl. into ENGLISH from Byul. Sov. Antarkt. Ekspeditsii (USSR), no. 22, 1960 p 32–35
(Contract AF 19(604)-8505)
(E-T-R-63-12; AD-430582)

The examination of an aerological cross section, which crosses through the tropical zones of both hemispheres, has made possible the explanation of the invasion of air from the Southern to the Northern Hemisphere. During the winter in the Southern Hemisphere, the intensity of the inflow of fresh air masses into the tropical zone of the Atlantic sector increases considerably. This naturally intensifies the process of air displacement toward the equator along the northeastern periphery of the Alantic subtropical maximum. Similar phenomena, only on larger scales, can be observed over the Pacific Ocean where, during the winter in the Southern Hemisphere, the air therefrom penetrates into the Northern Hemisphere and vice versa during the summer. The intensity of air penetration from one hemisphere to the other can qualitatively characterize cyclonic activity in the equatorial zone and the frequency of shifting from these regions to the temperate latitudes of tropical cyclones of the typhoon type, hurricanes, and other storms. I.v.L.

N64-16502 Woods Hole Oceanographic Institution, Mass.
HEAT FLUX AND SURFACE STRESS ON AND NEAR AN ISLAND IN THE TRADE WIND REGION Third Semi-Annual Progress Report, Jul. 15, 1963-Dec. 5, 1963
E. B. Kraus [1963] 19 p
(Contract DA-36-039-SC-90784)
(Rept. 63-46; AD-428784)

Plans for studying the interaction between the air and sea in low latitudes and under quasi-steady conditions that might permit repeatable observations or experiments are discussed. The effects of variation in the following parameters will be studied: (1) the sea surface condition, as represented by different locations relative to a flat island across the trade wind stream; and (2) the vertical stability, as represented by the daily variations in air temperature. Aruba has been selected as a working site. A description is given of the working buoy that

has been constructed to carry meteorological instruments without movement and without disturbance of the airflow, in a relatively heavy sea. R.T.K.

N64-16504 Oslo U., Blindern (Norway) Inst. of Theoretical Meteorology
A NUMERICAL INTEGRATION EXPERIMENT USING THE PRIMITIVE EQUATIONS FOR A TWO LAYER MODEL OF THE ATMOSPHERE Technical Note No. 3
A. Grammeltvedt 29 Oct. 1963 24 p refs
(Contract AF 61(052)-525)
(AFCRL-63-947; AD-430637)

A method is described for numerical integration of the primitive equations for an atmospheric model consisting of two material layers confined in a B-plane channel. Results are presented of a 24-hour integration based on geostrophic initial winds. Author

N64-16528 National Aeronautical Lab., Bangalore (India)
A STUDY OF THE HOURLY WIND SPEEDS AT JAIPUR FROM THE POINT OF VIEW OF WIND POWER UTILIZATION
M. S. Prakasa Rao and S. R. Radhakrishnan Apr. 1963 22 p refs
(TN-WP-25-63)

The hourly wind speeds at Jaipur (Rajasthan) obtained from the India Meteorological Department for the years 1958 to 1960 have been analyzed in this study to assess the wind power potentiality. Certain characteristics of wind, such as frequency distribution, spells of low winds, and the diurnal variation, are discussed. The annual energy output of an aerogenerator of 30-m^2 swept area and an overall power coefficient of 12% is estimated at 561 kwh. The annual water pumping capacity of a direct-acting windmill with the same overall power coefficient, but with a swept area of 23.6-m^2 (WP-2-type windmill) is estimated at about 17,550 kl (3,861,000 gal.), i.e., 10,580 gal. per day. The annual mean wind speed works out to 7 km.p.h. Author

N64-16542 Joint Publications Research Service, Washington, D.C.
FIFTH INTERDEPARTMENTAL CONFERENCE ON ATMOSPHERIC OPTICS AND ACTINOMETRY
G. Rozenberg 6 Mar. 1964 16 p Transl. into ENGLISH of an article from Usp. Fiz. Nauk (Moscow), v. 81, issue 3, Nov. 1963 p 566–573
(JPRS-23547; OTS-64-21725) OTS: $0.50

Efforts concerned with the following areas are discussed: (1) receding radiation and the interpretation of observations being made from artificial earth satellites; (2) the radiation condition of the free atmosphere; (3) the diffusion of light in the surface layer and the microstructure of the aerosol; (4) the transparency and transmission function of the atmosphere in the infrared zone of the spectrum and the problem of atmospheric moisture; (5) the optical properties of the thick layers of a diffusing medium and the underlying surfaces; (6) the luminescence and polarization of the daytime and twilight sky; (7) radiation balance; and (8) actinometrical equipment. I.v.L.

N64-16565 Queen's U., Belfast (Northern Ireland)
THE MEASUREMENT OF HIGH ALTITUDE WIND VELOCITIES FROM VAPOUR RELEASES. II.
F. J. Smith [1963] 22 p refs
(AFCRL-64-225; AD-430498)

A digital computer method is described for determining accurately and quickly the position in space of either a luminous vapor trail or a small luminous vapor cloud. The position is found by analyzing data from photographs of the object and of the star field from at least two camera positions. A correction is included to take account of the curvature of the earth's surface. Author

N64-16572 Chicago U., Ill. Labs. for Applied Sciences
ULTRAVIOLET VISIBLE AND INFRARED BACKGROUNDS Summary Report, May 1962–May 1963
R. J. Kauth and P. E. Le Blanc, ed. Sep. 1963 94 p refs
(Contract ARPA-SD-71)
(LAS-TR-199-45)

This report describes the general history of the background problem, the work done during this reporting period, and recommendations for future work on background problems. Cloud scattering in the infrared and clear-atmosphere scattering are the main topics investigated. An analysis of experimental data and recommendations for data processing are given. Background-radiation-measurement techniques and information services are also discussed. E.W.

N64-16705* Stanford Research Inst., Menlo Park, Calif.
MEDIUM RESOLUTION INFRARED (MRIR) AND HIGH RESOLUTION INFRARED (HRIR) DATA PROCESSING AND CONVERSION
H. F. Frohbach, R. M. Madvig, R. L. Mancuso, and M. Pollack Oct. 1963 98 p refs
(NASA Contract NAS5-1882; SRI Proj. 3927)
(NASA CR-55901) OTS: $8.60 ph, $3.14 mf

This report discusses the operational use of the MRIR and HRIR data, and the methods for preparing the data for use by operational meteorologists. A cartographic data format is recommended, and methods of showing the MRIR as contours, varying gray shades, and number symbols are discussed. A method for rectification of the data into standard map projections, such as polar stereographic in real time by means of a digital computer, is described. Author

N64-16823 Stanford Research Inst., Menlo Park, Calif.
AN INVESTIGATION OF THUNDERSTORM DISTRIBUTION OVER EXTENSIVE AREAS Scientific Report 2
Roy H. Blackmer, Jr. Nov. 1963 59 p refs
(Contract AF 19(628)-1681)
(AFCRL-63-910; AD-431550)

This report presents the results of investigations of the probable distributions of thunderstorms over extensive areas. Climatological records of the distribution of thunderstorm days show general areas of maxima and minima of thunderstorm activity and monthly fluctuations of these areas. Surface synoptic charts provide some knowledge of the locations of thunderstorm activity at a given time within the limitations of observational density. The utilization of photographic records to describe in detail the distribution of cloud cover over extended areas is discussed. The photographic data considered in this report were photographs of cloud cover from U-2 aircraft and TIROS satellites, and radarscope photographs of the precipitating regions of convective clouds. The report concludes with a discussion of additional studies required to relate thunderstorm occurrence and distribution to synoptic and topographic parameters. Author

N64-16869 Air Force Cambridge Research Labs., Bedford, Mass.
THE STRUCTURE OF OCCLUSIONS AS DETERMINED FROM SERIAL ASCENTS AND VERTICALLY-DIRECTED RADAR

Carl W. Kreitzberg (Ph.D. Thesis-Washington U., Seattle, 1963), Jan. 1964 122 p refs
(Contract AF 19(604)-5192)
(AFCRL-64-26; AD-432007)

The thermal, cloud, and precipitation structures of occluded frontal systems on both the meso- and synoptic-scales are examined. The data used include serial-ascent radiosonde observations of five systems and the time–height precipitation structure of these and many other frontal systems as obtained using vertically directed, 1.87-cm radar. Author

22 NAVIGATION AND GUIDANCE

Includes autopilots; star tracking; inertial platforms; and air traffic control. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; 20 Mathematics; and 29 Space Sciences.

N64-16170* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLIGHT CONTROL COMPUTER FOR SATURN SPACE VEHICLES
John M. Caudle and Donald C. Colbert (Electron. Commun.) *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 16 p (See N64-16151 08-08)

The flight control computer for Saturn receives attitude signals from the stable platform, rate signals from rate gyros or lead networks, and angle-of-attack information from body-fixed accelerometers or other sensors. These signals are a result of several forces acting on the vehicle such as engine thrust, wind, gravity, and internal vehicle flexing and bending. The signals are shaped, given a weighting function, and are combined with program data in several servo amplifiers. The resultant amplified outputs drive servo actuators that gimbal the engines to provide thrust vector control for the S-I and S-IV stages. Feedback signals from the actuators close the servo loop. Provisions are made to program or switch gains in any channel for the varying needs of the flight program as it progresses. Author

N64-16171 General Precision, Inc., Little Falls, N.J. Aerospace Systems Div.
MECHANIZATION OF A SELF-CONTAINED NAVIGATION SYSTEM
J. S. Gansler *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 15 p refs (See N64-16151 08-08)

This paper is concerned with the mechanization of a self-contained navigation system capable of performing all of the guidance and navigation necessary for a multiphased space mission. There are five major phases to this overall mission; boost, orbital operations, rendezvous, reentry, and abort at any time. The functions required to be performed by the guidance and control system during each of these five phases are presented. Author

N64-16174 Massachusetts Inst. of Tech., Cambridge Instrumentation Lab.
THE APOLLO GUIDANCE COMPUTER
Ramon L. Alonso and Albert L. Hopkins Oct. 1963 *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 11 p refs (See N64-16151 08-08)

The Apollo Guidance Computer (AGC), is an airborne digital computer designed to control, test, and operate a guidance system and to determine and execute changes in spacecraft velocity for optimum performance in a lunar mission. The computer is organized as a binary, fifteen digit (bit) "general purpose" computer employing parallel word transfer and single address instructions. Instructions and data are stored in a common body of memory composed of several thousand words of fixed, wired-in memory, and about one thousand words of erasable memory. Two types of interrupt functions are used in the computer to resolve the fundamental conflict between efficient programing and realtime system requirements. The logic of the computer is composed of three-input NOR gates in microcircuit form. Erasable memory selection is done with core-transistor circuits, and current drivers for fixed and erasable memory are diode-transistor circuits. Author

N64-16358 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE QUALITY OF FILLING FLOATING GYROSCOPIC INSTRUMENTS WITH A SPECIAL LIQUID
Z. F. Urazayev and V. Yu. Shishmarev 28 Mar. 1963 13 p refs Transl. into ENGLISH from a Russian book "Nekotorye Voprosy Sovremennoy Tekhnologii Priborostroyeniya" Moscow, Moskovskiy Aviatsionnyy Tekhnologicheskiy Institut, no. 52, 1961 p 52–60
(FTD-TT-63-148/1+2; AD-402601)

A method for obtaining a high degree of "filling quality" (the absence of air bubbles in an instrument that has been filled with a special liquid) is presented, and a mathematical approach to determining the filling quality is discussed. P.V.E.

N64-16386 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONTROL OF COSMIC SHIP
B. Dobronravova 23 Jul. 1963 10 p Transl. into ENGLISH from Kridla Vlasti (Czechoslovakia), no. 11, 29 May 1963 p 322–323
(FTD-TT-63-718/1+2; AD-414836)

Spacecraft control mechanisms for navigation, orientation, maneuver, and stabilization are summarized. R.L.K.

N64-16391 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EMPLOYMENT OF ASYMPTOTIC METHODS IN SOLVING PROBLEMS ABOUT THE MOVEMENT OF AN ASTATIC GYROSCOPE IN CARDAN SUSPENSION
D. M. Klimov and L. N. Slezkin 31 Jan. 1964 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 3, 1963 p 45–50
(FTD-TT-63-1038/1+2; AD-429881)

An asymptotic method is used to solve a system of two nonlinear differential equations of the second order, in which the characteristic determinant of the unperturbed system has, in addition to roots $\pm i\omega$, two zero roots with linear elementary denominators. As an example, the problem of the movement of an astatic gyroscope in Cardan suspension is discussed. The gyroscope has a rotor in dynamic nonequilibrium, and the axis of the suspension is acted upon by a small dry friction moment and a viscous friction moment. P.V.E.

N64-16404 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A SYSTEM FOR BALANCING AND DETERMINING THE TRIM OF FLOAT-TYPE GYROSCOPES

Yu. I. Paramonov 5 Mar. 1963 6 p Transl. into ENGLISH of Sov. Patent No. 147831 (744457/26-10) 12 Sep. 1961 1 p (FTD-TT-62-1880/1+2+4; AD-298658)

A system is proposed that increases accuracy in determining the trim and imbalance of float-type gyroscopes by employing an annular magnetic circuit with a solenoid equidistant from the pole tips in a controlled magnetic field. This system also contains a centrifuge, an iconoscope with a television set, digital scales, a potentiometer, and an illuminator. To balance the float, one pole tip of the magnetic circuit is connected through a reducing gear to an electric motor. C.L.W

N64-16405 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A METHOD OF BALANCING THE FLOAT IN FLOAT-TYPE GYROSCOPE DEVICES

V. P. Lymar 5 Mar. 1963 4 p Transl. into ENGLISH of Sov. Patent No. 147832 (745602/26-10) 25 Sep. 1961 1 p (FTD-TT-62-1881/1+2+4; AD-298660)

This method is based on the use of weights with a density equal to that of the liquid. A weight is attached to the float, and the float is balanced in the liquid and then in air. The use of weights makes it possible to effect a balance in air without upsetting the balance in the liquid, thereby increasing the accuracy and accelerating the process of balancing the float. C.L.W.

N64-16521* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

IMPLEMENTATION REPORT NO. 1 ON STUDIES IN THE FIELDS OF SPACE FLIGHT AND GUIDANCE THEORY

4 Oct. 1963 106 p refs

(NASA TM X-54562; MTP-AERO-63-70) OTS: $9.10 ph, $3.38 mf

CONTENTS:

1. PATH-ADAPTIVE GUIDANCE FOR SATURN V THREE-DIMENSIONAL ASCENT TO ORBIT R. S. Polovitch and W. B. Morgan (Boeing Co.) p 5–30 refs (See N64-16522 08-22)

2. SATURN V GUIDANCE EQUATIONS FOR POWER FLIGHT FROM PARKING ORBIT TO EARTH-TO-MOON TRANSIT S. Hu (Northrop Corp.) p 31–70 (See N64-16523 08-22)

3. RANGE CAPABILITY OF S-IVB AND SERVICE MODULE USED AS ABORT VEHICLES FROM SATURN V BOOST TRAJECTORIES V. V. Moore and F. G. Bourque (Boeing Co.) p 71–88 refs (See N64-16524 08-29)

4. REENTRY CORRIDOR FOR MANNED LIFTING VEHICLE Ann Muzyka and H. Elmore Blanton (Raytheon Co.) p 89–103 refs (See N64-16525 08-29)

N64-16522 Boeing Co., Seattle, Wash.

PATH ADAPTIVE GUIDANCE FOR SATURN V THREE-DIMENSIONAL ASCENT TO ORBIT

R. S. Polovitch and W. B. Morgan *In* NASA. Marshall Space Flight Center Implementation Rept. No. 1 on Studies in the Fields of Space Flight and Guidance Theory 1963 p 5–30 refs (See N64-16521 08-22) OTS: $9.10 ph, $3.38 mf

Pitch and yaw guidance polynomials for the Saturn V vehicle have been generated. These polynomials are designed to steer the vehicle into a space-fixed orbit at an altitude of 100 nmi. The polynomials are capable of acceptable orbit injection at any time during a 1-hour launch window. They also allow for variations in thrust, specific impulse, and weight in any of the stages, as well as perturbations due to winds during Stage 1 flight. Author

N64-16523 Northrop Corp., Hawthorne, Calif.

SATURN V GUIDANCE EQUATIONS FOR POWER FLIGHT FROM PARKING ORBIT TO EARTH-TO-MOON TRANSIT

S. Hu *In* NASA. Marshall Space Flight Center Implementation Rept. No. 1 on Studies in the Fields of Space Flight and Guidance Theory 1963 p 31–70 refs (See N64-16521 08-22) OTS: $9.10 ph, $3.38 mf

A set of guidance equations for power flight of the third stage of the Saturn V from parking orbit to earth-to-moon transit conic have been developed. This set consists of four polynomial expressions in terms of time and the state and vehicle performance variables. These equations provide the time of leaving the parking orbit, pitch and yaw steering angles during power flight, and time remaining to third-stage cutoff. The method utilized to obtain these guidance equations is based upon the calculus of variations. Author

N64-16588 Aerospace Corp., El Segundo, Calif. Systems Research and Planning Div.

AN AUTOMATIC LANDING SYSTEM FOR LOW LIFT-DRAG GLIDE VEHICLES

R. A. Nesbit 15 Nov. 1963 48 p refs

(Contract AF 04(695)-269)

(TDR-269(4540-50)-1; SSD-TDR-63-341; AD-431298)

The pitch plane dynamics of a landing vehicle are studied by analytic approximation and analog simulation. A landing system design is discussed for application to low lift–drag vehicles. Flare velocity loss minimization is studied using the maximum principle. Author

N64-16748* Mc Donnell Aircraft Corp., St. Louis, Mo.

OPTIMUM DIGITAL ADAPTIVE ATTITUDE CONTROL SYSTEM FOR SPACE VEHICLES Final Report

James C. Bowers 6 Jan. 1964 92 p

(NASA Contract NASw-614)

(NASA CR-53109; A405) OTS: $8.60 ph, $2.96 mf

The feasibility of the optimum digital adaptive attitude control system (ODAACS) was demonstrated by the results obtained from the simulation performed in this investigation. The most extreme changes in system parameters did not cause control instability, since the control program is designed to make the optimum decision based upon the measured state of the plant and to correct for any errors in the previous decision. The accommodated torque-to-inertia ratio range is a function of the ODAACS design. The design of the ODAACS control program, for a particular application, is simply the choice of θ_{L2}, $\dot{\theta}_c$ and ρ for the particular maximum and minimum acceleration anticipated. θ_{L2} are the attitude control limits, $\dot{\theta}_c$ is the limit cycle box, and ρ is a fixed number. The selection of $\dot{\theta}_L$, the rate limit for fuel consumption, is predicted on the tradeoff between fuel consumption and speed of response. Theoretically, there is no limit to either the range of accelerations or torque-to-inertia ratio that the ODAACS can control. Limit cycle control parameters are determined by the required attitude control limits and minimum pulse available ($\dot{\theta}_n$ and $\dot{\theta}_p$). The selection of $\dot{\theta}_n$ and $\dot{\theta}_p$ is influenced also by the anticipated bias torque. Input data must have a basic resolution of 12 bits to maintain accurate control. I.v.L.

N64-16876 Aerospace Corp., El Segundo, Calif. Systems Research and Planning Div.

STUDY OF STATION KEEPING USING LOW THRUST (ION) ENGINES

R. V. Soufl 8 Jan. 1964 36 p refs

(Contract AF 04(695)-269)

(TDR-269(4504-20)-1; SSD-TDR-63-374; AD-431841)

The problem of using low-thrust engines to control the position, period, and eccentricity of a satellite's orbit is examined. Equations describing the motion of a satellite in response to constant low-level radial and tangential thrusting are developed. A guidance logic for control of the position and period is developed using phase-plane techniques. A logic for control of eccentricity is also presented. The problem of orbit determination is also considered. Expressions relating period and position uncertainties as a function of the nominal orbit parameters, tracking errors, and tracking time are developed. Author

23 PHYSICS, GENERAL

Includes acoustics; cyrogenics; and optics. *For astrophysics see*: 05 Astronomy and Astrophysics. *For related information see*: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 25 Physics, Solid-State.

N64-16118* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IMPACT FLASH AT LOW AMBIENT PRESSURES
Robert W. Mac Cormack Washington, NASA, Mar. 1964 21 p refs
(NASA TN D-2232) OTS: $0.50

The initial rate of increase of the luminosity produced by 1/8-in.-diam aluminum spheres impacting aluminum targets at a nominal velocity of 2.5 km/sec in air at pressures from 4×10^{-4} to 2×10^{-1} torr (mm of Hg) was found to vary approximately as the 1/3 power of ambient pressure. Radiation produced solely by the cratering mechanism did not contribute significantly to the observed variation of impact flash. Luminosity produced by the interaction with the atmosphere of ejecta of particle radii greater than 10^{-5} cm and at velocities from 8 to 16 km/sec is consistent with the observed flash. The impact flash of the present tests is thus primarily if not completely an atmospheric phenomenon. At a higher atmospheric pressure of 400 torr, spectra of impact flash produced in air differed significantly from that produced in nitrogen. Author

N64-16126 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
MATERIALS TESTING REACTOR-ENGINEERING TEST REACTOR TECHNICAL BRANCHES Quarterly Report, 1 Jul.-30 Sep. 1963
J. R. Huffman, D. R. de Boisblanc, L. A. Schmittroth, and R. G. Fluharty AEC Natl. Reactor Testing Station, 15 Feb. 1964 66 p refs
(Contract AT(10-1)-205)
(IDO-16932) OTS: $1.50

This summary of program status includes: (1) Sample fuel platelets containing U_3O_8, UO_2 or UAl_3 in aluminum matrices were irradiated in the Engineering Test Reactor (ETR) at initial surface temperatures of 180° C to burnups of 1×10^{21} fiss/cc. Only the UAL_3 samples were in good condition at the end of the test. (2) Fission product transient curves extrapolate to about the same zero-time reactivity value with initial data varying from 30 minutes to 6 hours. (3) A reactor kinetics simulator and seven transport lag simulation channels have been put into service in the Analog Computer facility. (4) The fission cross section of Pu^{241} has been measured from 2.0 to 100 ev. (5) Transmission measurements have been obtained on a separated Pa^{233} sample containing approximately 10 mg of Pa_2O_5. (6) Averaged reduced partial differential scattering cross sections for a powder Be sample have been obtained. (7) A new data-processing system for transient data has been developed for use in the SPERT reactor complex. (8) An eight-input adapter and initial delay counter has been developed to increase the utility of an existing time-of-flight analyzer. (9) Rod-drop deceleration times have been measured on an ETR control rod. I.v.L.

N64-16127 Atomics International, Canoga Park, Calif.
EXPERIMENTAL STUDIES OF NEUTRON ATTENUATION IN NATURAL LITHIUM HYDRIDE SHIELDS
S. G. Wogulis and K. L. Rooney 12 Feb. 1964 45 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-9364)

Upon completion of the SNAP Shield Test Facility (STF), one of the first tasks undertaken was the measurement of the attenuation of fission neutrons in lithium hydride. The attenuation coefficients are obtained from assumed kernels of the form $e^{-\mu r}/4\pi r^2$. The measurements were carried out in a slab geometry, with a fission plate providing the neutron source. The experimental program provided a basic series of measurements of neutron attenuation from which the attenuation coefficient, μ, was obtained over the range of shield thicknesses of interest to current SNAP shields. Author

N64-16128 General Dynamics Corp., San Diego, Calif. General Atomic Div.
DIFFERENTIAL NEUTRON THERMALIZATION Annual Summary Report, 1 Oct. 1962-30 Sep. 1963
W. L. Whittemore Washington, AEC Div. of Tech. Inform., 15 Oct. 1963 91 p refs
(Contract AT(04-3)-167)
(GA-4434) OTS: $2.00

A large-aperture rotating mechanical chopper has been successfully incorporated in a neutron velocity selector of the electron linear accelerator. A system has been completed and put into full use to study the inelastic scattering of monoenergetic neutrons in a variety of materials. The scattering into various angular directions between 30° and 150° has been studied for incident neutrons with energies between 0.009 ev and 0.40 ev; most of the later work was done for $E_0 > 0.20$ ev. The exact incident energy was chosen to optimize the ability to study various chemical rotation and vibration levels in this higher energy region. The technical details of the experimental apparatus are abundantly discussed. Numerous details are given for neutron interactions in liquid methane, liquid parahydrogen, zircomium hydride, and polyethylene. Author

N64-16131 Cornell U., Ithaca, N.Y. School of Electrical Engineering
CONFINEMENT OF ELECTRON BEAMS
R. Rudko *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. I Dec. 1963 p 8-18 refs (See N64-16130 08-09)

This report describes the design and construction of an electron gun that will produce a magnetically confined electron beam. The construction of the gun is essentially the same as that of the Sperry STL-100 gun used to produce a Brillouin beam. However, instead of having the cathode magnetically shielded, magnetic flux is allowed to thread the cathode in such a way as to have the beam completely immersed in the magnetic field. By increasing the magnitude of this magnetic field, a confined electron beam will be produced by this gun. Author

N64-16132 Cornell U., Ithaca, N. Y. School of Electrical Engineering

SOLENOID FOR PRODUCING AXIALLY-VARYING MAGNETIC FIELDS

W. Rustay *In its* Theoret. and Exptl. Invest. of Linear-Beam Microwave Tubes, Vol. 1 Dec. 1963 p 19–24 (See N64-16130 08-09)

The construction of a solenoid having an axially symmetric magnetic field that varies in the axial direction is described. The solenoid is to be used in studying the continuous focusing of electron beams. P.V.E.

N64-16173 Martin Co., Baltimore, Md. Electronic Systems and Products Div.

VELOCITY MEASUREMENTS WITH MOSSBAUER EFFECT

R. B. Matthews and J. G. Henderson *In* IEEE New Links to New Worlds, 1963 Natl. Space Electron. Symp. [1963] 9 p refs (See N64-16151 08-08)

(Sponsored by AEC)

A precise velocity-measurement system, in which accuracy is independent of variations in the transmitting environment, appears feasible by applying the Mössbauer effect of nuclear "resonance" at gamma frequencies. Experiments were conducted to develop a precise velocity-measurement system, based on this effect, which could be used for such varied range and range-rate data requirements as a missile's initial trajectory, altitude for space vehicles attempting soft landings, and closure rates between a vehicle and a space station or another vehicle. The laboratory experiments have been paralleled by theoretical work, leading to a mathematical model of a general system. Results of these efforts should prove the feasibility of a velocity-measurement system and provide data needed for detailed prototype design. I.v.L.

N64-16190 Atomic Energy of Canada Ltd., Chalk River, Ontario

PHYSICS DIVISION PROGRESS REPORT, OCTOBER 1 TO DECEMBER 31, 1963

[1963] 59 p refs

(PR-P-60; AECL-1902)

Investigations in physics included research in nuclear physics, solid-state studies by neutron scattering, developments in solid-state radiation detectors, and developments in theoretical physics. A study made of alpha-particle groups from the reaction C^{12} (C^{12},α)Ne^{20} revealed a number of levels of spin with relatively high-energy yields. The normal vibrations in a single crystal of beta brass were studied using a triple-axis crystal spectrometer. Certain modes were selected that either were the most favorable for observation or exhibited frequency splitting due to small differences between the copper and zinc atoms. High-resolution spectrometers were used to study high-energy gamma rays. Finally, an investigation was made of the magnitude and energy spectrum of the neutron fluxes and currents that develop when targets, bombarded by high-energy protons, are surrounded by good moderating materials, such as light or heavy water. The effects upon the neutron flux of target size and material, moderator size and material, and experimental entry tubes within the moderator were also explored. C.L.W.

N64-16205 France. Ministere de l'Air, Paris

STUDY ON THE MECHANICAL AND PHOTOELASTIC BEHAVIOR OF A BIREFRINGENT BAR SUBJECTED TO VIBRATIONS [ETUDE DU COMPORTEMENT MECANIQUE ET PHOTOELASTIQUE D'UN BARREAU BIRIFRINGENT SOUMIS A DES VIBRATIONS]

Alexis Lagarde Serv. de Doc. et d'Inform. Tech. de l'Aeron. (SDIT), Sep. 1963 82 p refs In FRENCH

(*Its* Publ. Sci. et Tech. NT-127)

This investigation was conducted in the framework of the schematization of a bar subjected to longitudinal force vibrations. From the mechanical point of view, a mathematical model was determined that, in turn, permits the prediction, in an established sinusoidal regime, of the correct response as to constraint and deformation of viscoelastic materials to a sinusoidal excitation. From the photoelastic point of view, precise criteria were established that permit the assessment of the photoelastic effect in the case of constraint or of deformation. Trans. by I.v.L.

N64-16216 Joint Publications Research Service, Washington, D.C.

X-RAY DIFFRACTION RESEARCH

4 Mar. 1964 73 p refs Transl. into ENGLISH of 7 Russian and 2 Ukrainian articles

(JPRS-23510; OTS-64-21710) OTS: $2.00

CONTENTS:

1. THEORY OF X-RAY ABSORPTION SPECTRA A. I. Kostarev and I. B. Borovskiy p 1–11 refs (See N64-16217 08-23)

2. THEORY OF X-RAY ABSORPTION SPECTRA E. Ye. Vaynshteyn, R. L. Barinskiy, and K. I. Narbutt p 12–22 refs (See N64-16218 08-23)

3. FINE STRUCTURE OF THE BASIC X-RAY K-ABSORPTION SPECTRUM OF TITANIUM IN SOME DIELECTRIC MATERIALS E. Ye. Vaynshteyn, I. B. Staryy, and M. N. Bril' p 23–27 refs (See N64-16219 08-23)

4. SOME PRINCIPLES IN THE STRUCTURE OF THE BASIC X-RAY K-ABSORPTION EDGE OF ATOMS IN CRYSTALS OF ALKALI HALIDES E. Ye. Vaynshteyn, R. L. Barinskiy, and K. I. Narbutt p 28–33 refs (See N64-16220 08-23)

5. INVESTIGATION OF THE $K\beta_5$-BANDS OF THE X-RAY SPECTRUM OF IRON AND CHROMIUM DURING MAGNETIC TRANSFORMATIONS OF Fe-Cr ALLOYS V. A. Kazantsev p 34–37 ref (See N64-16221 08-23)

6. INVESTIGATION OF THE K-ABSORPTION EDGE OF CHROMIUM IN THE α AND σ-PHASES OF Fe-Cr ALLOYS V. A. Kazantsev p 38–40 refs (See N64-16222 08-23)

7. X-RAY DIFFRACTION RESEARCH ON THE FATIGUE MECHANISM OF FERROUS AND NONFERROUS METALS AND ALLOYS (SINGLE CRYSTALS AND POLYCRYSTALLINE SAMPLES) V. M. Buyko, V. Ye. Makogonov, Yu. S. Terminasov, and A. M. Toropov p 41–51 refs (See N64-16223 08-23)

8. CHARACTERISTICS OF CURVES OF THE INTENSITY OF X-RAY SCATTERING AND CURVES OF THE ATOMIC DISTRIBUTION OF LIQUID METALS I. V. Radchenko and I. M. Shapovalov p 52–66 refs (See N64-16224 08-23)

9. A NEW METHOD OF NORMALIZING THE EXPERIMENTAL CURVE OF INTENSITY OF X-RAY SCATTERING M. I. Gulivets' and I. V. Radchenko p.67–69 refs (See N64-16225 08-23)

N64-16217 Joint Publications Research Service, Washington, D.C.

THEORY OF X-RAY ABSORPTION SPECTRA

A. I. Kostarev and I. B. Borovskiy *In its* X-Ray Diffraction Res. 4 Mar. 1964 p 1–11 refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 26, no. 3, 1954 p 377–384 (See N64-16216 08-23) OTS: $2.00

The following topics related to the theory of the fine structure of X-ray absorption spectra of various substances are discussed: (1) the applicability of the Rydberg serial formula; (2) the relationship of theories of the main edge and peak of the X-ray absorption band; and (3) the X-ray spectra of ionic crystals. R.T.K.

N64-16218 Joint Publications Research Service, Washington, D.C.

THEORY OF X-RAY ABSORPTION SPECTRA

E. Ye. Vaynshteyn, R. L. Barinskiy, and K. I. Narbutt *In its* X-Ray Diffraction Res. 4 Mar. 1964 p 12–22 refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 27, no. 4, 1954 p 521–528 (See N64-16216 08-23) OTS: $2.00

This article contains a reply to the criticism of Kostarev and Borovskiy of the authors' method of determining the fine structure of the X-ray absorption edges. R.T.K.

N64-16219 Joint Publications Research Service, Washington, D.C.

FINE STRUCTURE OF THE BASIC X-RAY K-ABSORPTION SPECTRUM OF TITANIUM IN SOME DIELECTRIC MATERIALS

E. Ye. Vaynshteyn, I. B. Staryy, and M. N. Bril' *In its* X-Ray Diffraction Res. 4 Mar. 1964 p 23–27 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 105, no. 5, 1955 p 943–946 (See N64-16216 08-23) OTS: $2.00

The fine structure of the X-ray K-absorption spectra of titanium in three modifications of titanium oxide (rutile, brookite, and anatase), in addition to perovskite and ilmenite, was studied. The experimental results demonstrated the following: (1) The X-ray absorption spectra of titanium atoms in the metal and in the compounds differ as to position, shape, and relative intensity of the long-wave absorption line. (2) The shape, intensity, and energy position of the long-wave maximum in the absorption spectrum of titanium in compounds depend on the composition of the compound. (3) The fine structure of the K-absorption edge of titanium varies in the compounds studied. R.T.K.

N64-16220 Joint Publications Research Service, Washington, D.C.

SOME PRINCIPLES IN THE STRUCTURE OF THE BASIC X-RAY K-ABSORPTION EDGE OF ATOMS IN CRYSTALS OF ALKALI HALIDES

E. Ye. Vaynshteyn, R. L. Barinskiy, and K. I. Narbutt *In its* X-Ray Diffraction Res. 4 Mar. 1964 p 28–33 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 105, no. 6, 1955 p 1196–1199 (See N64-16216 08-23) OTS: $2.00

A method is described that permits consideration of both the structure of the X-ray K-absorption spectra of atoms in crystals of alkali halides and the disclosure of a regular relationship among them. R.T.K.

N64-16221 Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF THE $K\beta_5$-BANDS OF THE X-RAY SPECTRUM OF IRON AND CHROMIUM DURING MAGNETIC TRANSFORMATIONS OF Fe-Cr ALLOYS

V. A. Kazantsev *In its* X-Ray Diffraction Res. 4 Mar. 1964 p 34–37 ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 114, no. 1, 1957 p 86–87 (See N64-16216 08-23) OTS: $2.00

Magnetic transformations of the Fe–Cr system occurring under the influence of a change in composition and arising as a result of a change in the temperature of the alloys exert the same influence on the $K\beta_5$-bands of iron and chromium (on their shape, width, intensity, and energy). R.T.K.

N64-16222 Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF THE K-ABSORPTION EDGE OF CHROMIUM IN THE α AND σ PHASES OF Fe-Cr ALLOYS

V. A. Kazantsev *In its* X-Ray Diffraction Res. 4 Mar. 1964 p 38–40 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 115, no. 3, 1957 p 501–503 (See N64-16216 08-23) OTS: $2.00

The following results were obtained: (1) The K-absorption edge of chromium is displaced in the direction of lower energies when the alloy passes from the α phase into the σ phase. The shift of the point of inflection of the 3d-absorption band is 3.2 $\pm$0.4 ev. (2) The total width of the 3d-absorption band of Cr in the α phase is 11.2 ev, and the width of the 4sp-band is about 17 ev; transition to the σ phase is accompanied by a reduction of the width of these bands to 7 $\pm$0.8 ev and 13 $\pm$0.8 ev, respectively. R.T.K.

N64-16223 Joint Publications Research Service, Washington, D.C.

X-RAY DIFFRACTION RESEARCH ON THE FATIGUE MECHANISM OF FERROUS AND NONFERROUS METALS AND ALLOYS (SINGLE CRYSTALS AND POLYCRYSTALLINE SAMPLES)

V. M. Buyko, V. Ye. Makogonov, Yu. S. Terminasov, and A. M. Toropov *In its* X-Ray Diffraction Res. 4 Mar. 1964 p 41–51 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk), no. 5, 1959 p 93–101 (See N64-16216 08-23) OTS: $2.00

An X-ray diffraction study was conducted of the fatigue mechanism of metals (armco iron, brass, copper, aluminum) possessing various crystal sizes. This work explains the loss in strength by the metal during the fatigue process by intensive fractionation of the crystalline blocks (within limits producing no broadening of the lines or producing negligible broadening), leading to the formation of "loosening" in the crystal structure of the metals. Author

N64-16224 Joint Publications Research Service, Washington, D.C.

CHARACTERISTICS OF CURVES OF THE INTENSITY OF X-RAY SCATTERING AND CURVES OF THE ATOMIC DISTRIBUTION OF LIQUID METALS

I. V. Radchenko and I. M. Shapovalov *In its* X-Ray Diffraction Res. 4 Mar. 1964 p 52–66 refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 4, no. 1, 1959 p 5–16 (See N64-16216 08-23) OTS: $2.00

The curves of the intensity of X-ray scattering by liquid metals and the atomic curves obtained from them were compared. A review of the intensity curves of liquid metals leads to the following conclusions: (1) All the metals have a tendency in the liquid state to close packing of the atoms, which is manifested in a similarity of the general appearance of the intensity curves. (2) After melting, the metals retain some signs of that orderliness in the arrangement of the atoms that exists in the solid state. R.T.K.

N64-16225 Joint Publications Research Service, Washington, D.C.

A NEW METHOD OF NORMALIZING THE EXPERIMENTAL CURVE OF INTENSITY OF X-RAY SCATTERING

M. I. Gulivets' and I. V. Radchenko *In its* X-Ray Diffraction Res. 4 Mar. 1964 p 67–69 refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 8, no. 1, 1963 p 106–107 (See N64-16216 08-23) OTS: $2.00

A new method is proposed for reducing intensity of X-ray scattering to an absolute scale. The condition of constancy of the number of scattering centers in a large volume of the scattering has been set as a basis of the method. R.T.K.

N64-16245 Massachusetts Inst. of Tech., Cambridge
ELASTIC SCATTERING OF HIGH ENERGY BEAMS: REPULSIVE FORCES

I. Amdur and J. E. Jordan [1963] 80 p refs Submitted for Publication

The experimental and theoretical aspects of elastic scattering of high-velocity neutral beams, used in the determination of interaction potentials at small internuclear separation, are discussed. The reliability of the derived potentials is also discussed, along with applications to specific problems in which it is necessary to have a quantitative description of the intermolecular potential. C.L.W.

N64-16250 General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
ECONOMIC COMPARISON OF FUEL FABRICATION PROCESSES USED IN THE HIGH POWER DENSITY PROGRAM
Robert B. Hoffman Washington, AEC Div. of Tech. Inform., 25 Jun. 1963 36 p refs
(Contract AT(04-3)-361)
(GEAP-4294) OTS: $0.75

The fabrication costs of processes used in producing fuel rods are evaluated and compared economically. These processes include pelletized fuel with pellet-to-clad gap (4 to 9 mil) and with gap reduced by swaging, and compacted-powder fuel made by cold swaging, hot swaging, tandem rolling, and vibratory compaction. Time measurements of the labor involved in the different processes were made for the 2- and 3-pass, cold-swaged powder process and the reduced gap (swaged) pellet process using both ground and unground pellets. The results of the fabrication cost analysis for the various processes indicated that the tandem rolling process required the least amount of fabrication labor, followed by the swaged-powder, vibratory-compaction, and swaged-pellet fuel processes. Table IX lists the various fuel fabrication processes and their relative fabrication labor requirements. Author

N64-16261* Oklahoma State U., Stillwater
PENETRATION OF AN INITIALLY RADIAL SHOCK WAVE THROUGH AN ALUMINUM-GLASS INTERFACE
B. A. Sodek, Jr., and F. C. Todd Repr. from Proc. Okla. Acad. Sci., v. 43, 1963 p 173–182 refs
(NASA Contract NASr-7)

This paper presents an analytical study and computer solution for the propagation of an initially radial shock wave in Al through a plane interface into glass. The problem originates from the investigation of micrometeoroid impacts on photomultiplier tubes flown on space vehicles. The impacting micrometeoroid is assumed to initiate a radial shock wave in the Al, which propagates away from the point of impact as a hydrodynamic shock wave in a nonviscous fluid. The proposed problem is solved with approximate initial conditions in order to obtain information that will assist in evaluating the relative importance of other possible mechanisms, and to provide a basis for a more exact solution when the true delineating conditions are known. As the shock wave moves from Al into glass, the prime interest, for the calculation involved, is the reflection and the penetration of this wave at a plane interface. The interface moves during the impact, which differentiates the problem from the common seismic problem of reflection at an interface between two different media. I.v.L.

N64-16264 Laboratoire de Physique Théorique et des Hautes Energies, Orsay (France)
DEPOLARIZATION OF ELECTRONS IN MATTER
C. Bouchiat and J. M. Lévy-Leblond Jan. 1964 14 p refs FRENCH Summary Submitted for Publication

The depolarization of a number of electrons (positrons) in the course of a slowing-down process in matter is studied. Several mechanisms are considered, particularly the effect upon the nuclei of inelastic electron (positron)–electron collisions and of multiple scattering. The predictions are compared with the result of a recent experiment on the polarization of positrons coming from muon decay. Trans. by R.L.K.

N64-16265 Mound Lab., Miamisburg, Ohio
MOUND LABORATORY PROGRESS REPORT FOR MAY, 1963
J. F. Eichelberger, G. R. Grove, L. V. Jones, and E. A. Rembold 31 May 1963 21 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1157)

The following areas of research are summarized: (1) adhesives and plastics research—effects of temperature and aging on the electrical resistivity of conductive adhesives; (2) radioelements research—polonium isotope studies and desorption of radium-223, barium-140, and strontium-90 from hydroxide residues; (3) isotope separation—carbon-13, xenon, and thermal-diffusion theory; (4) alpha and neutron source development; and (5) analytical research—krypton-85 studies. P.V.E.

N64-16266 Mound Lab., Miamisburg, Ohio
MOUND LABORATORY PROGRESS REPORT FOR JUNE 1963
J. F. Eichelberger, G. R. Grove, and L. V. Jones 28 Jun. 1963 32 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1160)

Research activities in the following areas are summarized: (1) radioelements research—half-life of tritium (12.355 ±0.010 years), production of polonium isotopes by irradiation, determination of coincidence correction for counting instruments, ruanium-234 separation, potassium–plutonium sulfate dihydrate studies; (2) isotope separation—carbon-13 and thermal diffusion; (3) alpha and neutron source development; and (4) analytical research—beryllium analysis by gamma activation and low-level krypton counting. P.V.E.

N64-16269* Southern Research Inst., Birmingham, Ala.
EVALUATION OF THE PERFORMANCE OF TUNGSTEN – TUNGSTEN 26 RHENIUM THERMOCOUPLES TO ABOUT 5000°F Final Report, Task Order 1
Johnny G. Allen and C. D. Pears 19 Jul. 1963 30 p
(NASA Contract NAS8-5196)
(NASA CR-55626) OTS: $2.60 ph, $1.10 mf

The thermocouples were calibrated in a blackbody cavity in an inert atmosphere, and the output of the couples versus temperature was compared to the calibrations supplied by the manufacturers. For the Fenwal couple, the calibrations provided a higher output, which suggested that their calibration did not provide sufficient immersion in an isothermal zone if a 32° F reference was used. For the PDL couple the calibration curve

obtained was shifted, but essentially parallel, to the one provided by the manufacturer; this suggested that the cavity was not black or that temperature measurements were made in such a way that the emittance was unknown and assumed to be unity, whereas it was actually lower. The immersion depth should have been sufficient. Repeated runs were made to establish the repeatability and to obtain the relationship of millivolt output versus immersion depth. The output was less with shorter immersion depths up to about 4 diameters immersion. Author

N64-16283 California U., Berkeley Lawrence Radiation Lab.
HIGH-ENERGY PARTICLE DATA. VOLUME I — KINEMATICS OF PARTICLES AS A FUNCTION OF KINETIC ENERGY
W. Peter Trower, Beverly Hill Willis, and Charles V. Stableford
1 Jul. 1963 129 p refs
(Contract W-7405-ENG-48)
(UCRL-2426, Vol. 1 (Rev.)) OTS: $2.50

Graphs are given displaying kinematic quantities as functions of particle energy for the most common elementary particles. Dynamic quantities are also presented as functions of incident particle kinetic energy for the most common elementary particles interacting with a proton. C.L.W.

N64-16287 Purdue U., Lafayette, Ind. School of Aeronautical and Engineering Sciences
CALCULATION OF THE THERMAL ACCOMMODATION COEFFICIENTS OF A DIATOMIC GAS
P. Feuer Dec. 1963 21 p refs
(A&ES-63-2)

In an earlier report, a general theory of the thermal accommodation coefficient was developed for diatomic gases. This general theory is now applied to some special cases, and numerical values are obtained for α_t and for α_i/α_t, where α_t is the accommodation coefficient associated with the change of translational energy of a beam of gas molecules reflected from a solid surface and α_i is the coefficient associated with the change in rotational energy. Author

N64-16293 Advisory Group for Aeronautical Research and Development, Paris (France)
JET NOISE
M. J. Lighthill Apr. 1963 40 p refs Presented at the AGARD Specialists Meeting on the Mech. of Noise Generation in Turbulent Flow at the Training Center for Exptl. Aerodynamics, Rhode-Saint-Genèse, Belgium, 1–5 Apr. 1963
(AGARD-448)

The acoustic efficiency of undisintegrated jets (including those associated with aircraft and rockets) depends principally on the ratio M of the jet speed to the atmospheric speed of sound, varying approximately as $10^{-4} \times M^5$ for low M but being constant (about 0.006) for high M, and changing from one form to the other rather abruptly around M = 2. Improved measurements of jet turbulence (particularly in a frame of reference moving with the eddies) and an improved theory of the acoustic radiation from eddies convected at speeds exceeding the atmospheric sound speed are used to show how this form of acoustic efficiency variation, and the associated changes in directional distribution and frequency spectrum, can be explained in terms of a comprehensive theory. This theory represents a jet as a distribution of acoustic quadrupoles in an otherwise undisturbed atmosphere, the quadrupole strengths being well correlated only within convected eddies of limited extent and limited lifetime. Author

N64-16294 Advisory Group for Aeronautical Research and Development, Paris (France)
MEASUREMENTS OF NEAR FIELD PRESSURE OF SUBSONIC JETS
E. Mollo-Christensen Apr. 1963 54 p refs Presented at the AGARD Specialists Meeting on the Mech. of Noise Generation in Turbulent Flow at the Training Center for Exptl. Aerodynamics, Rhode-Saint-Genèse, Belgium, 1–5 Apr. 1963
(AGARD-449)

This report describes a series of measurements of pressure space–time covariance in the near field of several subsonic jets. The data include measured mean flow data, turbulence levels, and power spectral densities of the pressure field outside the jet. Among the obvious conclusions is the fact that the far field is first established for high frequencies as the distance between jet and detector is increased. A less expected result is the long correlation distances for the larger eddies and the strong correlation across a diameter observed both in the transitional regime and in the fully turbulent domain. The correlation measurements show a distinction between phase velocity and group velocity of large-scale disturbances. Author

N64-16295 Advisory Group for Aeronautical Research and Development, Paris (France)
INCOMPRESSIBLE FLOWS AND SOUND RADIATION
A. R. Paterson Apr. 1963 17 p refs Presented at the AGARD Specialists Meeting on the Mech. of Noise Generation in Turbulent Flow at the Training Center for Exptl. Aerodynamics, Rhode-Saint-Genese, Belgium, 1–5 Apr. 1963, sponsored by the AGARD Fluid Dynamics Panel
(AGARD-460)

This report examines the effect of compressibility on the generation of spund and uses the compressibility as a small perturbation in a turbulent flow. In the theory of sound for potential flows the generation of sound by a body that is small comapred with the wavelength generated may be calculated by first solving Laplace's equation near the body, and then matching an outgoing wave to the asymptotic form of this solution of Laplace's equation. A corresponding device may be used for general flow. The result of this work is the radiation pressure in terms of integrals of the velocity field in the generation region; the shape of the result is a sum of quadrupole sources together with a simple source. The simple source is due to the compressibility of the fluid. Author

N64-16297 Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
X-RAY MASS ATTENUATION COEFFICIENTS IN THE RANGE OF 50 TO 150 kvp WITH DATA FOR SEVERAL REACTOR MATERIALS
B. E. Foster and J. W. Evans Feb. 1964 51 p refs
(Contract W-7405-ENG-26)
(ORNL-3552)

The materials examined were types 304 and 347 stainless steel, Zircaloy-2, type 1100 aluminum, and uranium-aluminum alloys of 7, 18, and 25 wt % U. All attenuation coefficients determined were narrow-beam coefficients. To prevent the detection of any photon that experienced a large deflection angle, the X-ray beam was finely collimated; as a part of the collimation, the detector was well shielded and located far from the absorber. Mass attenuation coefficients were determined as the summation of the fractional absorption caused by the significant constituent elements within the limits of predetermined energy ranges. Author

N64-16299 Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, JANUARY 1964
R. M. Adams and A. Glassner 15 Feb. 1964 105 p refs
(Contract W-31-109-ENG-38)
(ANL-6840) OTS: $2.25

Activities in the following areas are discussed: (1) boiling-water reactors, Borax-V; (2) liquid-metal-cooled reactors—general fast reactor physics, general fast-reactor fuel development, EBR-I (Experimental Breeder Reactor), EBR-II, and Faret; (3) general reactor technology—experimental reactor and nuclear physics, theoretical reactor physics, high-temperature materials development, heat engineering, chemical separations, and plutonium recycle program; (4) advanced systems research and development—advanced research reactor, rocket-fuel test reactor, magnetohydrodynamics, and regenerative EMF (electromotive force) cells; and (5) nuclear safety—thermal-reactor safety studies, fast-reactor safety studies, and TREAT (transient reactor test facility). R.T.K.

N64-16312 Argonne National Lab., Ill.
ANALYTICAL STUDY OF THE TRANSFER FUNCTION OF EBR-I MARK IV
Jiro Wakabayashi (Kyoto U.) Sep. 1963 60 p refs
(Contract W-31-109-ENG-38)
(ANL-6773) OTS: $1.50

The dynamic behavior of liquid metal-cooled fast reactors for small perturbations was investigated systematically. The reactivity feedback mechanisms analyzed theoretically in this report are due to the following: (1) axial expansion of a fuel slug; (2) radial expansion of a fuel slug; (3) cladding expansion; (4) coolant expansion in the core; (5) coolant expansion in the blanket; (6) axial expansion of a blanket slug; (7) bowing of a fuel slug in the jacket; and (8) expansion of a fuel-assembly tube. The numerical analysis was done for the EBR-I Mark IV, and the results of the analysis showed a good agreement with those of experiment. Author

N64-16317* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ROCKET-GRENADE EXPERIMENT
W. Nordberg and W. Smith Washington, NASA, Mar. 1964 37 p refs
(NASA TN D-2107) OTS: $1.00

This manual describes the grenade technique, which is employed to measure average ambient temperature and winds in horizontal layers between two successive grenade explosions. The technique is effective up to altitudes of ninety km. The method for deriving pressures and densities from the temperature information is discussed in detail. And finally, rocket-borne and ground-based instrumentation is delineated. Author

N64-16360 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERTAIN PROBLEMS CONCERNING THE MOVEMENTS OF A CONDUCTIVE VISCOUS GAS IN THE PRESENCE OF MAGNETIC AND ELECTRIC FIELDS
V. P. Shidlovskiy 7 Jun. 1963 10 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 5, 1961 p 10–15
(FTD-TT-63-202/1+2; AD-412974)

Problems are discussed of stable laminar gas flow between two infinitely long coaxial cylinders, rotating uniformly at different angular velocities. Two variants are discussed of the electric and the magnetic field vectors, E and H. The electric field in the first variant appears to be radial, and the magnetic field appears axial; in the second variant there are axial electric fields and an annular magnetic field. First integrals of basic differential equations are obtained, and it is shown that in order to obtain an accurate solution it is necessary to integrate a system of conventional differential equations, and to determine the dependence of the viscosity and electroconduction of the gas upon its heat content. Calculations show that the presence of magnetic and electric fields leads to a change in the angular velocity profile and to a rise in the heat content within the gas layer. C.L.W.

N64-16368 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEVICE FOR THE OBTAINMENT OF STATIC MAGNETIC CHARACTERISTICS OF FERROMAGNETIC MATERIALS
V. A. Kadkii 21 Jun. 1963 6 p Transl. into ENGLISH from Russian Patent no. 147672 (697260/24), 11 Feb. 1961 p 1–3
(FTD-TT-63-435/1+2; AD-413073)

The device described is a cathode oscillograph. Its novelty consists in the use of a coil of a doubled mechanical rectifier sitting on a displacement shaft, connected into the circuit of two independent secondary windings of the amplifier's output transformer. The rectified voltage taken from one of these windings feeds the horizontal oscillograph plates, and the second winding feeds the vertical plates, in sequence and counter to the voltage drop created by the magnetization current. The installation allows the creation of an automatic displacement of points of magnetization curves and hysteresis loops. A schematic drawing of the proposed device is included. E.W.

N64-16369 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF SOUND WAVE SCATTERING IN THE ATMOSPHERE
M. A. Kallistratova 25 Jun. 1963 79 p refs Transl. into ENGLISH from a Russian book "Atmosfernaya turbulentnost" Tr. Inst. Fiz. Atmosfery, no. 4, p 203–256
(FTD-TT-63-441/1+2+4; AD-412821)

This report describes the instrumentation and procedure for making a direct study of a sound signal being scattered at a definite angle, with a localized volume, in a turbulent atmosphere. The results of the experimental study of the dependence of the intensity of sound scattering, at a frequency of 11 kc, on the scattering angle and on the characteristics of the turbulence are presented. The relationship obtained is then compared with theory. I.v.L.

N64-16373 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROPAGATION OF ELASTIC-PLASTIC LOAD WAVE IN A ROD OF FINITE LENGTH
A. I. Buravtsev 19 Jun. 1963 12 p refs Transl. into ENGLISH from Vestnik Leningrad. Univ. no. 1, 1963 p 79–85
(FTD-TT-63-506/1+2; AD-412966)

Equations are given that describe the propagation of elastic–plastic waves in a rod, the axes of which coincide with axis x. It is assumed that deformations are small and that the effect of the rate of deformation on the stress dependence curve is disregarded. C.L.W.

N64-16382 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTRO-FILTER TYPE EF-2

16 Jul. 1963 3 p Transl. into ENGLISH from the pam. "Vystavki Lostizhenii Narodnogo Khozyaystva" SSSR, Atomizdat, v. 25, no. 6, 1960 1 p
(FTD-TT-63-639/1; AD-414978)

An electrofilter, intended for the deposition of alpha and beta active aerosols from air samples of industrial quarters, is described. The component parts are: (1) a head with a manual vacuum cleaner, type PR-55; (2) a high-voltage rectifier for 10 to 20 kv at a load current up to 1 ma; and (3) a pumping device. Precipitation of aerosols is realized on a removable target, 40 mm in diameter, with a polished surface. The current through the electrofilter is regulated smoothly and measured with the aid of a miliamperemeter. Also, the technical qualities of the filter are described. I.v.L.

N64-16385 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE DOPPLER EFFECT WHEN MOVING THROUGH A HETEROGENEOUS MEDIUM
G. D. Yakovleva, O. I. Yakovlev, and A. I. Rogashkova 25 Jul. 1963 13 p refs Transl. into ENGLISH from "Radiotek. i Elektron." (Moscow), v. 8, no. 3, 1963 p 416–424
(FTD-TT-63-673/1+2; AD-415015)

A method is discussed for analyzing the Doppler effect during the movement of a receiver through a heterogeneous medium, when the change in dielectric permeability in the heterogeneity is little different from the dielectric permeability of the surrounding space. An expression is given for the Doppler change in frequency when the receiver moves in a heterogeneity having a cylindrical and a spherical form. A case of the Doppler effect in a statistically heterogeneous medium is discussed. I.v.L.

N64-16393 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE CALCULATION OF THE IONIZING INTENSITY OF THE ELECTRICAL FIELD OF A LAMINATED DIELECTRIC MADE OF IMPREGNATED CAPACITOR PAPER
D. S. Varshavskiy 15 Oct. 1962 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy, Fiz. (Tomsk), no. 6, 1961 p 22–26
(FTD-TT-62-1263/1+2+4; AD-292199)

Equivalent circuits for impregnated capacitor paper are examined and, on their basis, an expression is derived for the ionizing intensity of the electrical field in a dielectric. The reasons for the discrepancy between the data obtained on the basis of this expression and the experimental results are analyzed. An expression is derived for the determination of the ionizing intensity in a laminated dielectric made of impregnated capacitor paper that agrees satisfactorily with the experimental data. Author

N64-16422 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INFRARED TECHNOLOGY IN COSMOS
A. Sergeyev 21 Jun. 1963 5 p Transl. into ENGLISH from Trud, no. 56, 7 Mar. 1963 p 3
(FTD-TT-63-444/1; AD-414257)

Infrared techniques can be used in orientation systems and in controlling the position of manmade earth satellites in space, as well as in determining the altitude of their orbit. The orientation system includes infrared and gyroscopic feelers, logical electronic devices, and control motors. The thermal contrast between the surface of the earth and cosmic space is measured, and the local vertical of the satellite is then determined. Infrared devices are also mounted on manmade earth satellites that are sent up for meteorological investigations. Carbon dioxide and water vapor, which are contained in the atmosphere, exert a great effect on the temperature and climate of the earth and, at the same time, act as radiation-energy filters between the surface of the earth and cosmic space. In addition, the measurement of infrared radiation in the "transparency window" of the atmosphere enables the determination of the temperature of the underlying surface (continent or ocean). I.v.L.

N64-16424 California U., Berkeley. Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT NO. 35, JULY THROUGH SEPTEMBER 1962
Kennith C. Crebbin and Rudin M. Johnson 16 Dec. 1963 25 p refs
(Contract W-7405-ENG-48)
(UCRL-10626) OTS: $0.50

There was no Bevatron operation this quarter. The long shutdown for shielding and injector changes continued. The new linac injector was tested at full energy (19.2 Mev) at currents up to 25 mA. The ion source was run at 460 kv with up to 100-mA currents available. The beam-transport-system magnets were completed, and the beam was run through part of the system. Author

N64-16434 Uppsala U., Sweden Quantum Chemistry Group for Research in Atomic, Molecular and Solid-State Theory
QUANTUM THEORY OF MANY-PARTICLE SYSTEMS Final Report, Jan. 1, 1960–Aug. 31, 1963
Per-Olov Lowdin [30 Sep. 1963] 26 p refs
(Contract AF 61(052)-351)
(ARL-63-246; AD-429228)

Investigations by quantum-mechanical methods of the electronic structure of atoms, molecules, and solid-state matter are reviewed. Also, a complete, chronological list of technical notes and published papers is presented. I.v.L.

N64-16437 Massachusetts U., Amherst Polymer Research Inst.
DYNAMIC BIREFRINGENCE OF POLYOLEFINS
K. Sasaguri and R. S. Stein 21 Nov. 1963 29 p refs
(Contract Nonr-3357(01))
(ONR-TR-65; AD-429923)

The use of the dynamic birefringence method was extended to the study of the relationship between structural changes and mechanical properties for polyethylene, atactic and isotactic polypropylene, and polybutene-1. The phase angle between birefringence and strain was measured and permitted the resolution of the strain optical coefficient into real and imaginary parts. The real and imaginary parts of the dynamic relaxation modulus were also measured and compared with the optical data. Results for the crystalline polymers were interpreted in terms of the two-stage mechanism of deformation, involving spherulite deformation followed by internal crystalline reorientation. For the atactic polymer, the viscoelastic flow of amorphous regions contributes to the birefringence. The temperature dependence of birefringence and stress is similar for this mechanism but not for the crystalline contribution. Author

N64-16442 Hughes Research Labs., Malibu, Calif. Quantum Physics Dept.
STIMULATED RAMAN SCATTERING AND RELATED PARAMETRIC EFFECTS. APPENDIX
Robert W. Hellwarth *In its* Laser Devices Exploratory Invest. [1964] p A-1 to A-27 refs (See N64-16441 08-25)

Stimulated Raman scattering (SRS) of light from frequency ω_p to the Stokes shifted frequency ω_p-w has been extensively studied. Under certain experimental conditions this SRS is accompanied by weaker emission at frequencies $\omega_p \pm nw$ where n may take on many positive integral values. It is the purpose of this paper to make a first step toward a fundamental understanding of this mutiplet of lines (which is called an "SRS ladder") by calculating a somewhat unrealistic model problem, where the Raman active material is enclosed in a perfectly conducting cavity and illuminated by an absolutely monochromatic source. The power in the SRS ladder lines is estimated by assuming that the output originates from amplified quantum noise, and powers are found that are not unlike those from experiments. Ways to extend the model and to improve the approximations are discussed. Author

N64-16465 General Electric Co., Philadelphia, Pa. Re-Entry Systems Dept.
HIGH VELOCITY RATIO NEAR FREE MOLECULAR FLOW
J. Enoch and N. Macri 12 Feb. 1964 37 p ref
(Contract AF 04(694)-222)
(Rept. 64SD489; AD-430100)

The problem of high-velocity ratio near free molecular flow past a narrow strip is studied from the point of view of a previously developed kinetic model. The finite strip problem is approximated by the infinite strip problem. The logarithmic divergences arising in the infinite strip problem are handled by means of a cutoff procedure, which is discussed in detail. Extensive numerical calculations of all the relevant aerodynamic quantities are presented. Author

N64-16467 Minnesota U., Minneapolis
COMMENTARY ON HEAT AND MASS TRANSFER IN BOUNDARY LAYERS; REVIEW AND EXTENSION OF APPROXIMATE METHODS Technical Report No. 3
Dae Hyun Cho 16 Sep. 1963 131 p refs
(Contract DA-11-022-ORD-3084)
(AD-430289)

Salient points in this review are: (1) Complex features of heat and mass transfer in boundary layers are found, especially in large, potential gradient transfer, in which case, the variation of transport properties through the boundary layers should be taken into account. The unique characteristic of mass transfer lies in the interfacial velocity, normal to the wall, caused by diffusion. (2) The most exact solutions are known for wedge-type flows with constant properties, for which "similar" equations (f and π equations) are exact. "Similar" equations are the starting point of most approximate methods, and such methods are restricted practically to the case of constant properties. (3) An extension of Nickel's method to the case of heat and mass transfer is possible. "Similar" solutions may be used as "permissible" functions to estimate lower bounds of relative wall fluxes in two-dimensional arbitrary geometry. Such lower bounds can be good approximations of relative wall fluxes, except near a stagnation point. (4) Integral methods seem to be of value in the case of variable properties. Also, Nickel's simple estimation of the boundary layer is given in the appendix. I.v.L.

N64-16476 Massachusetts U., Amherst Polymer Research Inst.
THE TRANSMISSION OF CRYSTAL AGGREGATES BETWEEN POLARIZERS
R. S. Stein and S. Clough 26 Nov. 1963 25 p refs
(Contract Nonr-3357(01))
(ONR-TR-67; AD-430189)

A mathematical analysis is presented of the transmission of light, for an orientated polymer film, between polaroids with their polarization directions set at any arbitrary angle. Covered in the analysis are: (1) the transmitted amplitude for a two-dimensional uniaxially anisotropic body between polaroids; (2) the effect of correlated orientation; and (3) the transmission through a three-dimensional spherulite. I.v.L.

N64-16493 Kiel U. (W. Germany)
NEW METHOD OF MEASURING TRANSITION PROBABILITIES Technical Documentary Report, Jun. 1962
F. Karstensen and J. Richter Wright-Patterson AFB, Ohio, AF Mater. Lab., Jan. 1964 33 p refs
(AF EOAR Grant 62-114)
(RTD-TDR-63-4177; AD-430730)

A combination of intensity and lifetime measurement methods for obtaining atomic transition probabilities is described Lifetime measurement methods are discussed, and two experimental arrangements are described. First results of the measurements are given. Author

N64-16526 Oak Ridge National Lab., Tenn.
SORPTION OF GASES BY VAPOR-DEPOSITED TITANIUM FILMS
R. E. Clausing Mar. 1964 52 p refs
(Contract W-7405-ENG-26)
(ORNL-3481) OTS: $1.25

The usefulness of such films for ultrahigh speed vacuum pumping is appraised. The sorption of hydrogen, deuterium, oxygen, nitrogen, carbon monoxide, carbon dioxide, water vapor, helium, argon, and methane onto titanium films was measured for a variety of circumstances using techniques and apparatus developed for this specific purpose. Sticking fractions larger than 0.8 were obtained for hydrogen, deuterium, oxygen, nitrogen, carbon monoxide, and carbon dioxide. The experiments have shown that the sticking fraction for gases on vapor-deposited films is a function of the deposition conditions. There is strong evidence to support the supposition that conditions that favor the formation of a porous, fine-grained film structure with a large surface-to-volume ratio produce films with the highest sorption rates. Author

N64-16537 Oak Ridge National Lab., Tenn.
A SOLUTION TO THE NUCLEON-MESON CASCADE EQUATIONS UNDER VERY SPECIAL CONDITIONS
R. G. Alsmiller, Jr. Mar. 1964 28 p refs
(Contract W-7405-ENG-26)
(ORNL-3570) OTS: $0.75

The equations that describe a one-dimensional nucleon-meson cascade are solved under the following assumptions: (1) The secondary-particle production kernels are taken to be of the special form $F_{ij}(E',E) = \alpha_i \gamma_j \, e^{\nu(E'-E)}$ for all i, j and $\alpha_i, \gamma_j, \nu = \text{const.}$ (2) Pion decay is neglected. (3) Pion and nucleon nonelastic cross sections are taken to be constant. (4) The stopping powers of all charged particles are equal to the same nonzero constant. Author

N64-16539 Advisory Group for Aeronautical Research and Development, Paris (France)
THE CALCULATION OF THE FLUCTUATING LIFT ON A CIRCULAR CYLINDER AND ITS APPLICATION TO THE DETERMINATION OF AEOLIAN TONE INTENSITY
J. H. Gerrard (Manchester U.) Apr. 1963 22 p refs FRENCH summary
(AGARD-463)

The formation of vortices behind a circular cylinder in incompressible flow is discussed both physically and theoretically. A comparison is made between theoretical and experimental values of the oscillating lift experienced by the cylinder. The variation of aeolian tone intensity with Reynolds number is discussed and related to the oscillating lift and the correlation length of fluctuation at points separated along the length of the cylinder. Author

N64-16540 Advisory Group for Aeronautical Research and Development, Paris (France)
MECHANISMS OF AERODYNAMIC SOUND PRODUCTION
A. Powell (Calif. U.) Apr. 1963 28 p refs FRENCH summary: Previously published as a preprint; see N63-16325 13-11
(AGARD-466)

Sound production and flow instability are two inseparable characteristics of any compressible fluid flow. The vorticity of the compressible flow field may be considered to induce the complete flow field, which includes the radiated sound field as an integral part. The theory is developed and demonstrated by application to a free flow, the sound power being shown to depend on the eighth power of the flow velocity. In the case of aeolian tones, the vortex shedding is directly associated with the sound field. This is also true of the edge-tone phenomenon where the vortex shedding also reacts on the jet flow itself causing a selective feedback, which, together with the instability characteristic, gives rise to the distinctive frequency characteristics. Measurements confirm that the effective sound source is of the dipole type, with the acoustic power depending on the jet velocity raised to the sixth power. Author

N64-16548 California U., Livermore Lawrence Radiation Lab.
METHOD AND APPARATUS FOR QUANTITATIVE NEUTRON ACTIVATION ANALYSIS OF LARGE SAMPLES
William H. Hutchin 8 Jan 1964 9 p refs
(Contract W-7405-ENG-48)
(UCRL-7616) OTS: $0.50

A method and apparatus have been devised to irradiate large multiple samples simultaneously in a nonuniform neutron flux. A capsule containing the samples and flux monitors is rotated about an axis at constant speed with samples fixed in a symmetrical geometry, so that each position receives the same integrated neutron flux. Author

N64-16549 California U., Berkeley Lawrence Radiation Lab.
ENERGY-MASS DISTRIBUTIONS AND ANGULAR MOMENTUM EFFECTS IN HEAVY-ION-INDUCED FISSION
Franz Plasil (Ph.D. Thesis) 31 Dec. 1963 104 p refs
(Contract W-7405-ENG-48)
(UCRL-11193) OTS: $2.50

This work involves measurements of the energy and mass distributions of fission fragments produced by the bombardment of a number of relatively light elements with heavy ions. The results have been interpreted in terms of an approximate version of the liquid drop model that applies to this region of elements. The energies of both fission fragments from every event considered have been measured with solid-state detectors, and recorded in a correlated manner. The energy data have been transformed to give mass-total kinetic energy density-of-events distributions. The reactions studied were (1) $Er^{170} + O^{16} = Os^{186}$; (2) $Yb^{174} + C^{12} = Os^{186}$; and (3) $W^{182} + O^{16} = Pb^{198}$. Author

N64-16556 Mound Lab., Miamisburg, Ohio
RADIOISOTOPES FOR HEAT SOURCES I: CALCULATIONS FOR PREPARATION OF U^{222} BY IRRADIATION OF Th^{230} AND Th^{232}
K. W. Foster 24 Feb. 1964 14 p
(Contract AT(33-1)-GEN-53)
(MLM-1182) OTS: $0.50

Calculations were made to determine the quantity of uranium-232 that could be obtained from a 30,000-kg mixture of 15% thorium-230 and 85% thorium-232. The calculations indicated that the starting material could be recycled 14 times in a reactor with an assumed flux of 3×10^{14} neutrons cm^{-2} sec^{-1} to yield 3.3 kg of uranium-232. Author

N64-16557 Du Pont De Nemours (E.I.) and Co., Aiken, S. C. Savannah River Lab.
MOSSBAUER EFFECT IN FERREDOXIN
William L. Pillinger and John A. Stone Jan. 1964 17 p refs
(Contract AT(07-2)-1)
(DP-878) OTS: $0.50

The Mössbauer effect in ferredoxin enriched with Fe^{57} was measured at 298°, 195°, and 77°K. A two-line velocity spectrum was observed at each temperature. The hyperfine splitting, the shift from zero velocity, the line widths, and the absorption strength all increase with decreasing temperature. The spectrum behaves as a doublet, split by the electric quadrupole interaction. Line broadening at room temperature suggests the presence of additional unresolved splitting. The magnitude of the shifts and splittings in ferredoxin are consistent with an interpretation of covalently bound iron. Author

N64-16560 Rochester U., N.Y.
INTERMEDIATE VECTOR MESONS AND UNITARY SYMMETRY
Susumu Okubo 14 Jan. 1964 12 p refs
(Contract AT(30-1)-875)
(UR-875-19)

A theory is formulated of the weak interaction in connection with the unitary symmetry model by introducing intermediate vector mesons, both charged and neutral. It is assumed that weak baryonic currents of the interaction are components of some unitary octets. The resulting effective interaction for nonleptonic processes, violating the strangeness number of elementary particles, is also assumed to be a component of another unitary octet. It is shown that a theory can be established by utilizing a minimum of four distinct vector mesons. C.L.W.

N64-16561 Rochester U., N.Y.
LOWER BOUNDS ON THE LEHMANN WEIGHTS IN SPIN ZERO MESON THEORY
C. R. Hagen 15 Jan. 1964 12 p refs
(Contract AT(30-1)-875)
(UR-875-20)

It is shown within the framework of conventional spin zero meson theory that if all renormalizations are assumed finite, the Lehmann weights of the fermion and meson Green's functions cannot decrease arbitrarily rapidly as a function of energy. Author

N64-16564 Queen's U., Belfast (Northern Ireland)
THE PROPERTIES OF HELIUM AND THE TWO-ELECTRON SYSTEMS
A. L. Stewart [1963] 122 p refs
(AFCRL-64-224; AD-430816)

The helium isoelectronic sequence is studied to test the validity of quantum electrodynamic theories of the interaction between electrons, and to explore the accuracy of approximate methods that may be applied to more complex atomic systems. The simplicity of the two-electron systems makes it possible to derive solutions of high accuracy, using approximate methods, without a prohibitive amount of analysis and computation. Energy values have been calculated that have an accuracy of the same order of magnitude as that of spectroscopic measurements. E.W.

N64-16569 Midwestern Universities Research Assn., Madison, Wis.
PARTICLE DYNAMICS IN LINEAR ACCELERATORS
Phil Lee Morton (Ph. D. Thesis—Ohio State U.) 1963 121 p refs
Contract AT(11-1)-384)
(MUNA-679) OTS: $2.25

Problems of particle dynamics in a standing-wave Alvarez linear accelerator with quadrupole focusing magnets are treated. The previous single particle theories are extended to take into account the coupling between the longitudinal and transverse motion of a particle. The Hamiltonian governing the particle motion is derived and then used to obtain an adiabatic invariant for particles which travel along the axis. From this Hamiltonian the frequencies of small amplitude transverse and longitudinal oscillations are obtained as functions of the particle energy. The adiabatic invariant for on-axis particles is used to obtain the longitudinal oscillation amplitude. The Hamiltonian is transformed by the use of Moser theory to obtain a new Hamiltonian, which is then used to treat the coupling between transverse and longitudinal particle motion. Author

N64-16571 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
MANUAL OF RADIOCHEMICAL METHODS
D. G. Olson, ed. AEC Natl. Reactor Testing Station, 3 Jan. 1964 88 p refs
(Contract AT(10-1)-205)
(IDO-14613) OTS: $2.00

The radiochemical methods used for the determination of specific nuclides are described. Pertinent information on sample type, kind of separation, and time required for the determination are noted as headlines on each procedure. Thirty-two methods are presented. Author

N64-16577 California U., Berkeley Coll. of Engineering
CHARACTERIZATION OF PARTICULATE SYSTEMS
D. W. Fuerstenau and A. L. Mular *In its* Critical Compilation of Ceram. Forming Methods Jan. 1964 p 6-17 (See N64-16576 08-17)

An attempt is made to define and summarize the state of the knowledge dealing with basic particle and powder properties and behavior. There are two classes of basic properties of importance to characterization—those associated with the particle, and those that are characteristic of the assembly of particles. Because the production method may influence important properties of particles, various production processes are considered, including comminution, precipitation, and atomization. Properties dependent upon the physical and chemical nature of the particles and particle assemblies are also discussed. E.W.

N64-16598 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ENGINEERING JOURNAL (SELECTED ARTICLES)
20 Jun. 1963 30 p refs Transl. into ENGLISH of 3 articles from Inzh. Zh. (USSR), v. 1, no. 3, 1961 p 60-64, 153-156, and 161-165
(FTD-TT-63-509/1+2+4; AD-413125)

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2. CONCERNING THE LIMITS OF APPLICABILITY OF A RELAXATION MODEL OF BOLTZMANN'S KINETIC EQUATION V. S. Galkin p 10-17 refs (See N64-16600 08-23)
3. INVESTIGATION OF A FLOW IN A DISCHARGE ARRANGEMENT V. N. Gusev p 18-27 refs (See N64-16601 08-24)

N64-16599 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONCERNING AN ALMOST FREE-MOLECULAR FLOW OF RAREFIED GAS PAST BODIES
R. S. Iroshnikov *In its* Eng. J. (Selected Articles) 20 Jun. 1963 1-9 refs (See N64-16598 08-23)

It is demonstrated that at sufficiently large values of the Knudsen number, K, the correction of the values of the aerodynamic characteristics that must be introduced (according to the free-molecular theory, because of collisions that occur during flow past arbitrary cylindrical bodies) is proportional to log K/K. R.T.K.

N64-16600 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONCERNING THE LIMITS OF APPLICABILITY OF A RELAXATION MODEL OF BOLTZMANN'S KINETIC EQUATION
V. S. Galkin *In its* Eng. J. (Selected Articles) 20 Jun. 1963 p 10-17 refs (See N64-16598 08-23)

The following approach to solutions of the Boltzmann equation is described: using specific assumptions concerning the collision patterns of molecules, simplifications of the right-hand, integral part of Boltzmann's equations are made. The equation obtained is used as a model of the Boltzmann equation and maintains the basic qualitative features of that equation, but it is simpler than the Boltzmann equation; it is a relaxation model of the equations. R.T.K.

N64-16621 Wisconsin U., Madison Mathematics Research Center
THE USE OF SINGULAR INTEGRALS IN WAVE DIFFRACTION PROBLEMS WITH THE SOLUTION OF THE PROBLEM OF SCATTERING BY A DIELECTRIC WEDGE
Michael Papadopoulos Nov. 1963 77 p refs
(Contract DA-11-022-ORD-2059)
(MRC-440; AD-430767) OTS: $7.60

The following are discussed: (1) stages in the formulation of a problem in complex function theory—the infinite prism, the scattered field, a plane-wave representation of a homogeneous field in two dimensions, the singular-wave representation for the scattered field, and dual conditions in the complex plane; (2) the solution of the complex variable problem—calculation of the scattered field for the wedge system with hard walls, degenerate cases, and the wedge system with perfectly soft walls; (3) specific examples with detailed solutions—the case $\alpha_a = \alpha_b = 1$, the hard-walled wedge

system with $\alpha_a = 1/2$, $\alpha_b = 1$, and diffraction by a prism; (4) the diffraction of scalar plane waves at skew incidence; (5) the diffraction of singular scalar fields by a wedge system—the scattered field for an infinite line source, the scattered field for a point source, and the solution of the vector scattering problem of electromagnetic theory. R.T.K.

N64-16625 General Electric Co., Schenectady, N.Y. Research Lab.
PYROMETER CORRECTION DUE TO DIMER ABSORPTION IN Cs VAPOR Scientific Report No. 5
J. M. Houston and P. K. Dederick Feb. 1964 9 p refs
(Contract AF 19(604)-8424)
(AFCRL-64-208; AD-430855)

Lapp and Harris have recently shown that light absorption by alkali-vapor atmospheres can cause a significant error in optical pyrometer readings. This report gives their result for Cs vapor in a form more suitable for quick reference in Cs thermionic converter work; i.e., the pyrometer correction is plotted versus Cs reservoir and optical-path temperature, rather than versus dimer partial pressure. Author

N64-16649 Naval Ordnance Lab., White Oak, Md.
TEMPERATURE-YIELD STRENGTH CORRELATION OF THE CRATER SIZE PRODUCED IN ALUMINUM BY THE HYPERVELOCITY IMPACT OF ALUMINUM SPHERES
R. Piacesi, R. H. Waser and V. C. D. Dawson Mar. 1964 12 p refs
(NOLTR 63-142; Ballistics Res. Rept.-108; AD-431736) OTS: $1.60

An investigation was made to determine the correlation between target temperature and target yield strength for the hypervelocity impact of aluminum spheres upon semi-infinite aluminum targets. It was shown that an exact correlation does exist. In the velocity range covered in the experiment (12,700 fps to 21,750 fps) the crater volume was dependent on the −0.396 power of the yield strength. It was also observed that a transition region exists at an impact velocity of about 13,000 fps such that the crater volume is not linearly dependent on the kinetic energy of the projectile, but that for velocities from 13,000 fps and up to at least 21,750 fps the crater volume is dependent on the velocity to the 1.78 power. Author

N64-16670 Rochester U., N.Y.
QUARKS, TRIALITY AND UNITARY SYMMETRY SCHEMES
C. R. Hagen and A. J. Macfarlane 5 Mar. 1964 9 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-22)

The following subjects are discussed: (1) the existence of "quarks" (particles) in the Ne'eman, Gell-Mann theory of unitary symmetry, (2) the concept of triality type for irreducible representations of SU_3, and (3) the existence of a higher unitary symmetry or even of a hierarchy of such symmetries. R.T.K.

N64-16673 California U., Livermore Lawrence Radiation Lab.
THE LPTR SINGLE-CRYSTAL NEUTRON SPECTROMETER AND REACTOR SPECTRUM MEASUREMENTS
Ian R. Jones 1 Dec. 1963 59 p refs
(Contract W-7405-ENG-48)
(UCRL-7611)

A single-crystal neutron spectrometer was designed and built for use at the Livermoore Pool Type Reactor. Design considerations such as instrument resolution, collimator design, shielding, and component precision are discussed. The calibration and alignment of the spectrometer and its individual components are described in detail. The problems of measuring reactor spectra with a single-crystal neutron spectrometer are considered individually. The equations commonly employed in the calculation of crystal reflectivity are shown to be deficient, and appropriately modified equations are presented. A reactor spectrum measurement was made with the instrument, and these modified equations were employed in the analysis of the data. The spectrum was measured from 0.5 to 4.0 A (0.327 to 0.0051 ev) using the (111) planes of a lead single crystal. The effective neutron temperature was found to be 361° ± 7° K, which is 51° ± 7° K above the average moderator temperature of 310° K. The experimental results are compared with a theoretical Maxwellian distribution, and the differences are discussed. Author

N64-16679* Xavier U., Cincinnati, Ohio
THE FOUNDATIONS OF QUANTUM MECHANICS
F. G. Werner Repr. from Phys. Today, Jan. 1964 5 p refs Account of the Proc. of the Conf. on the Found. of Quantum Mech., 1–5 Oct. 1962
(NASA Grant NsG-315)

A conference was held to discuss some questions concerning the foundations of quantum mechanics. Among the topics discussed were the following: the significance of potentials in the quantum domain; a quantum-mechanical description of states and measurements; the concept of observation in quantum mechanics; evolution of the physicist's picture of nature; observable operators and the distinguishing of observable operators; and the best way to define a classical object from the point of view of quantum theory. P.V.E.

N64-16680* Yeshiva U., New York, N.Y. Belfer Graduate School of Science
DYNAMICAL STUDY OF BROWNIAN MOTION
J. L. Lebowitz and E. Rubin Repr. from Phys. Rev., v. 131, no. 6 15 Sep. 1963 p 2381–2396 refs
(NASA Grant NsG-227-62; AF AFOSR Grant 62-64)

The motion of a Brownian particle in a fluid is studied from a dynamical point of view, without the introduction of purely stochastic elements. The Brownian particle is distinguished primarily by having a mass M that is much greater than the mass of the fluid particles m. The study method consists of rewriting the Liouville equation for μ, the joint distribution of fluid and Brownian particle, as a pair of coupled equations for the distribution function of the Brownian particle f and the conditional distribution of the fluid $P = (\mu/f)$. The equation for P is then solved formally in a perturbation series in the square root of the mass ratio (m/M), which is then substituted in the equation for f to obtain a collision term δf representing the effect of the fluid on f. Two situations are considered: (1) a constant external force acts on the Brownian particle and f is stationary, the external force being balanced by δf; and (2) a general time-dependent f. Author

N64-16682* Rochester U., N.Y.
OPTICAL PROPERTIES OF "LIUMOGEN": A PHOSPHOR FOR WAVELENGTH CONVERSION
N. Kristianpoller and David Dutton Repr. from Appl. Opt., v. 3, no. 2, Feb. 1964 p 287–290
(NASA Contract NASw-107)

Optical and physical properties of the phosphor 2,2'-dihydroxy-1,1' napthaldiazine ("liumogen") have been investigated. Emission, absorption, and excitation spectra have been measured, as well as dependence of the emission upon the excitation wavelength and the temperature. Methods of sample preparation have been tested. The compound appears to have some notable advantages as a wavelength conversion detector. The material may be sublimed in vacuum without decomposition, and thus may be used in the form of thin transparent films. These films show a reasonable stability. The absorption edge occurs at ≈4,600 A; the main emission is in the yellow-green spectral region. The luminescence quantum yield of the phosphor is nearly independent of the excitation wavelength from 4,600 A to at least 900 A. The efficiency increases by a factor of ≈2 upon cooling to 80° K. Author

N64-16688* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
CALCULATED TEMPERATURE HISTORIES OF VAPORIZING DROPLETS TO THE CRITICAL POINT
Paul R. Wieber Repr. from AIAA Journal, v. 1, no. 12, Dec. 1963 p 2764–2770 refs
(NASA RP-138)

Digital computations of droplet steady-state temperatures and droplet mass and temperature histories were made to determine if droplet temperatures could approach the critical point. Pressures to 2000 psia were investigated. At sufficiently high pressure, the calculations showed both heptane and oxygen droplets heating to their respective critical temperatures. With increasing total pressure, a reduction occurred in both the downstream distance after injection and the mass evaporated before the droplet reached the critical point. This implied that a vaporization model may be inadequate in describing overall combustion rates at high total pressures. Rapid droplet heating rates indicated that droplets could approach the critical point during combustion instability at high pressures. This phenomenon could thus be involved in a mechanism for high-pressure combustion instability. Author

N64-16689* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
FREE-POSITRON ANNIHILATION MEAN LIFE IN DIATOMIC AND RARE GASES IN LIQUID AND SOLID STATES
D. C. Liu and W. K. Roberts Repr. from Phys. Rev., v. 132, no. 4, 15 Nov. 1963 p 1633–1635 refs
(NASA RP-140)

Measurements have been made on the freepositron annihilation mean life, τ_1, in H_2, D_2, He, N_2, O_2, Ne, Ar, and Xe in liquid and/or solid states. To a fair approximation, the observed mean lives may be represented by the equation: τ_1 (nsec) = $0.31 + 0.15 \times 10^{-4}\ \underline{E}i^2/\rho_e$, where $\underline{E}_i$ is the first electron ionization potential in ev, and ρ_e is the number of outermost electrons per unit "atomic volume" α_0^3. In the H_2 and D_2 isotopes where $\underline{E}_i$ is constant, τ_1 is linearly dependent on ρ_e^{-1}. It was found that τ_1 is dependent of the ortho-para ratio of the liquid H_2 at 20.4° K. Author

N64-16690* University of Southern Calif., Los Angeles
ON THE EQUATION OF STATE OF OLIGOMER AND POLYMER LIQUIDS
Robert Simha and A. J. Havlik Repr. from J. Am. Chem. Soc., v. 86, no. 197, 20 Jan. 1964 p 197–204 refs
(NASA Grant NsG-343)

By examining published volume–temperature data at atmospheric pressure for several series of oligomer and high polymer liquids, the principle of corresponding states is shown to be valid over the whole range available, namely up to reduced volumes $\tilde{V}$ of about 1.6. Such diverse structures as the polymethylenes, polyoxyethylenes, and phosphonitrilic fluorides are included. For $\tilde{V} \geq 1.1$, the theoretical equation of state, based on the application of cell theory in its simplest form to chain liquids, is obeyed for oligomers and high polymers. Computed thermal expansivities are in satisfactory agreement with experimental results for the high polymer liquids. By means of an additional experimental quantity, chosen here to be the low temperature enthalpy of vaporization or the cohesive energy density, numerical values of the characteristic volume, energy, and flexibility parameters are derived for the methylene, styrene, dimethylsiloxane, and perfluoromethylene series. Similarities and differences in respect to molecular flexibility are discussed. Author

N64-16693 Bettis Atomic Power Lab., Pittsburgh, Pa.
FABRICATION DEVELOPMENT OF BORON CARBIDE AND BORON CARBIDE + SILICON CARBIDE MIXTURES FOR POSSIBLE APPLICATION AS LUMPED BURNABLE POISONS IN PWR-2
S. F. Kaufman Jan. 1964 47 p refs
(Contract AF(11-1)-GEN-14)
(WAPD-244) OTS: $1.00

Wafers having densities greater than 99% theoretical were produced from B_4C and SiC powder mixtures ranging from 0 to 80 v/o SiC. The effects of starting powder purity and size, blending and hot pressing variables, volume fraction of SiC upon density, and microstructure are presented. The effect of density, B_4C particle size, and B_4C volume fraction upon the corrosion behavior in 680° F water is given. Factors affecting the preparation of hot-pressed B_4C containing boron enriched or depleted in the isotope B^{10} are also discussed. The fabrication of these wafers into Zircaloy-clad elements by eutectic diffusion bonding and gas-pressure bonding, as well as the characteristics of these plate-type elements, is described. Author

N64-16698 Battelle Memorial Inst., Columbus, Ohio
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING DECEMBER, 1963
Russell W. Dayton and Ronald F. Dickerson 1 Jan. 1964 65 p
(Contract W-7405-ENG-92)
(BMI-1659(Del.)) OTS: $1.50

Research activities in the following areas are discussed: (1) reactor materials and components; (2) studies of fuels; (3) general fuel-element development; (4) radioisotope and radiation applications; (5) coated-particle fuel materials—materials development program, fuel-irradiation program, and supporting research program; (6) corrosion studies of the fluoride-volatility process; (7) progress on fission-product deposition studies; (8) gas-cooled reactor program; and (9) joining of regenerative cell components. P.V.E.

N64-16712* Technical Operations, Inc., Burlington, Mass.
HYPERVELOCITY IMPACT STUDIES Final Report
V. E. Scherrer and R. W. O'Neil 21 Jun. 1963 39 p ref
(NASA Contract NAS1-2057; Contract AF 33(616)-8423)
(NASA CR-55899; TO-B 63-51) OTS: $3.60 ph, $1.37 mf

Methods of accelerating spherical and cylindrical particles to velocities in excess of 60,000 fps were investigated. Targets of 2024-T3 aluminum were bombarded with two sizes of Mylar, aluminum, and copper particles. Since it was discovered that some particle mass was lost during acceleration, a careful independent study was made to determine the particle mass at the time of impact. Author

N64-16718* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FAR-FIELD ACOUSTIC LEVELS RESULTING FROM TITAN LAUNCHES
Richard N. Tedrick 17 Apr. 1962 22 p refs
(NASA TM X-54632; MTP-TEST-62-3) OTS: $2.60 ph, $0.86 mf

Test Division personnel from Marshall Space Flight Center acoustically monitored the launch of Titan intercontinental ballistic missiles from CCMTA on October 6 and 24, 1961. This was done for operational checkout prior to the first Saturn launch and to obtain far-field data from a smaller booster of known size and thrust to compare with that from a Saturn vehicle launch. The data generally show the same pattern as that from the Saturn test. The peak energy was found to exist in the 50-cps octave band. As in the Saturn data, atmospheric fluctuations were found to exist at a 10-mile range. Author

N64-16727* Hughes Aircraft Co., Culver City, Calif. Space Systems Div.
STUDY ON OPTICAL COMMUNICATIONS FROM DEEP SPACE Interim Progress Report, 1 Feb.-27 Mar. 1963
Kenneth L. Brinkman [1963] 119 p refs
(NASA Contract NAS9-879)
(NASA CR-55813; SSD 3166R) OTS: $9.60 ph, $3.77 mf

The modulation and demodulation task is fully reported in this volume. While the principal emphasis in that work has been placed on an examination of wide bandwidth systems with the goal of providing real-time TV capability, the feasibility of utilizing such capability at these extreme ranges is strongly dependent on the state-of-the-art of other system parameters. As a result, techniques for providing narrower bandwidths are also discussed. A treatment of atmospheric attenuation studies is given. This is followed by a discussion of the extremely important pointing problem, the result of which is seen to have considerable impact on the design bandwidth. The report concludes with a treatment of the system implementation problem and discusses the advantages and disadvantages of the various communications links. Author

N64-16737* Western Ontario U., London (Canada)
THEORETICAL AND EXPERIMENTAL STUDIES IN ASTROPHYSICS Semi Annual Status Report No. 2, Aug. 1, 1963-Jan. 31, 1964
R. W. Nicholls 1964 13 p refs
(NASA Grant NsG-349)
(NASA CR-53100) OTS: $1.60 ph, $0.80 mf

Information is presented on the following research activities: (1) intensity measurements on molecular spectra; (2) general molecular spectroscopy of electronic band systems; (3) compilation of an atlas of molecular spectra; (4) shock-tube spectroscopy; (5) plasma jet studies; (6) electron-beam spectroscopy; (7) ion-beam spectroscopy; (8) X-radiolysis of gases; (9) ablation studies; (10) impact-flash spectroscopy; (11) laser excitation of powdered solids; (12) molecular potentials and vibrational wavefunctions; (13) Franck-Condon factors and r-centroids; (14) vibration-rotation interaction; (15) atomic collisions; (16) electron-hydrogen collision; (17) photoionization of H−; and (18) computation methods. R.T.K.

N64-16752* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
MOLECULAR ORBITAL STUDY OF THE B $^1\Sigma_u^+$ AND $^3\Sigma_u^+$ STATES OF THE HYDROGEN MOLECULE
Howard S. Taylor (U. of Southern Calif.) Repr. from J. Chem. Phys., vol. 39, no. 12, 15 Dec. 1963 3375-3381 p refs
(NASA Contract NAS7-100)
(NASA CR-53081; JPL-TR-32-499)

The molecular orbital method is applied to the calculation of the potential curve of the B $^1\Sigma_u^+$ and of the $^3\Sigma_u^+$ states of the hydrogen molecule. Results comparable to those obtained using much more complicated wavefunctions are obtained. Author

N64-16755* Michigan U., Ann Arbor High Altitude Engineering Lab.
ERRORS IN ATMOSPHERIC TEMPERATURE STRUCTURE SOLUTIONS FROM REMOTE RADIOMETRIC MEASUREMENTS
S. Roland Drayson Dec. 1963 30 p refs
(NASA Contract NASr-54(03); ORA Proj. 05863)
(NASA CR-53120; Rept. 05863-4-T) OTS: $2.60 ph, $1.10 mf

Calculations have been made that show that the library method of solution of the Kaplan experiment yields temperature structure solutions that are dominated by the random errors in measurement and computation of radiation. A least squares method of solution is developed and modified by consideration of the eigenvalues and eigenvecters of the matrix equation. It exhibits some of the limitations of the experiment and shows that, using radiometric measurements, certain quite different profiles are essentially indistinguishable from one another. Author

N64-16757* IIT Research Inst., Chicago, Ill. Technology Center
INVESTIGATION OF LIGHT SCATTERING IN HIGHLY REFLECTING PIGMENTED COATINGS Quarterly Report, 1 Oct. 1963-1 Jan. 1964
G. A. Zerlaut, S. Katz, and J. Stockham 29 Jan. 1964 45 p
(NASA Contract NASr-65(07); IITRI Proj. C6018)
(NASA CR-53118; IITRI-C6018-6) OTS: $4.60 ph, $1.55 mf

The first portion of this report deals with the scattering of light by nontransparent spheres. Both partially absorbing and totally reflecting spheres are discussed. The preparation of silver halide sols for the determination of optical properties is also discussed. In the ultraviolet, the reflectance of silver chloride coatings inverts with respect to concentration at approximately 2,800 A, and the maximum reflectance shifts toward larger wavelengths as the concentration increases. This inversion and shift have not been noted for larger particles. Angular light-scattering measurements were made on these films with the Brice-Phoenix light-scattering photometer. Comparison of the radial distribution of back-scattered light for various particle sizes with the theoretically predicted distribution gives a qualitative agreement. Author

N64-16814 Royal Swedish Academy of Sciences, Stockholm Nobel Inst. of Physics
RESEARCH IN THE VACUUM ULTRAVIOLET
Manne Siegbahn Wright-Patterson AFB, Ohio, Aerospace Research Labs., Dec. 1963 17 p refs
(ARL-63-233; AD-431187)

Experienced gained in the design, construction, and fabrication of two experimental vacuum ultraviolet spectrographs is reported. A spark source used in the testing of the instruments is also described. Author

N64-16822 Centre National de la Recherche Scientifique, Paris (France)
FAR INFRARED SPECTRA OF CRYSTALS AND SOLIDS IN A LARGE RANGE OF TEMPERATURES Annual Summary Report, 1 May 1961-30 Apr. 1963
J. Lecomte and A. Hadni (Nancy U.) 31 May 1963 15 p refs
(Contract AF 61(052)-518)
(AFCRL-64-22; AD-430749)

The far-infrared spectra of crystals and solids at liquid helium and room temperatures were investigated, and the results are: (1) Normal frequencies were ascribed for CsI, Cu_2O, SnI_4, $Hg(CN)_2$, and Hg_2Cl_2. (2) Yaroslawski's suggestion of hydrogen bending should be considered in regard to the dichroism of the 70μ absorption band of quartz. (3) The effect of temperature on the far-infrared lattice absorption spectra of single crystals was: (a) The maximum of absorption was shifted to shorter wavelengths when the temperature was decreased. (b) The transmission increased and this effect was much more noticeable on the low-frequency wing of the absorption band. The effect (a) was generally expected. The importance of effect (b) was unexpected. The results of (b) are interesting from two points of view. Theoretically, (b) seems to confirm that the vertical transitions from acoustical to optical branches of any wave are infrared active in a second-order approximation. Technically, (b) indicates that if it is true that at room temperature there is a great lack of materials, which are transparent in the far infrared, the situation is reversed at low temperatures, at which many single crystals become transparent. I.v.L.

N64-16826 Aerospace Corp., El Segundo, Calif. Aeromechanics Dept.
FORCED MOTION OF A PLATE
J. P. Jones 28 Jan. 1964 36 p refs
(Contract AF 04(695)-169)
(BSD-TDR-63-110; TDR-169(3153-10)TN-2; AD-431297)

In many cases of interest to experimentalists and geophysicists, the situation exists where a light, thin layer of material such as glue or adhesive is bonded to a heavier structure. This report considers the dynamic problem of a thin layer forced by displacements on the lower face and tractions upon the upper face. The exact solution is derived for the two-dimensional case while the three-dimensional case is first considered using Bernoulli–Euler–Kirchhoff plate theory and, after this, including the effects of shear deformation and rotatory inertia. It is found that if shear deformation and rotatory inertia are included, the theory is fairly accurate for problems in which the quarter wavelength of the disturbance is greater than or equal to the plate thickness. Author

N64-16842 North Carolina U., Chapel Hill
Technical Progress Report, 1 Oct. 1961-30 Jun. 1963 [INTERDISCIPLINARY PROGRAM IN THE MATERIAL SCIENCES]
Wayne A. Bowers et al Jul. 1963 46 p refs
(ARPA SD-100)
(AD-432134)

Research projects that were carried out as part of the interdisciplinary program in the materials sciences (Advanced Research Projects Agency) are summarized. Some of the projects included in the report are investigations in: lattice dynamics, reflectivity measurements in the vacuum ultraviolet, nuclear magnetic relaxation by intermolecular dipole-dipole interactions, critical phenomena and solubility curves in binary liquid systems, magnetoresistance of thin permalloy films, and adsorption of metal complexes on electrode surfaces. P.V.E.

N64-16845 Alabama U., University
SUBMILLIMETER RADIATION FROM RELATIVISTIC ELECTRONS Final Technical Report
3 May 1963 5 p refs
(AF AFOSR Grant 62-329)
(AD-432143) OTS: $1.10

The current program status includes the following: (1) The interaction of a bunched beam with the fields propagated by a corrugated cylindrical waveguide structure is being investigated. Design criteria for the waveguide structure have been devised. Cold radiofrequency tests have been conducted on waveguide structures scaled to a C-band, and the results have been compared to theory. A waveguide structure, scaled to a 7.5-mm wavelength, has been designed and is being electroformed. (2) The development of a linear accelerator for the production of a bunched beam of 3- to 5-Mev electrons has been completed. (3) The calibration of an analyzing magnet intended to produce, by separation, a beam with a small energy spread has been completed. This magnet is to be used in the study of the energy dependence of the radiation. I.v.L.

N64-16867 Parke Mathematical Labs., Inc., Carlisle, Mass.
THEORETICAL CORRECTIONS FOR DETERMINING RESISTIVITY CHANGE OF METALS CAUSED BY ELECTRON BOMBARDMENT Scientific Report No. 2
Charles H. Sherman Dec. 1963 37 p refs
(Contract AF 19(628)-2419)
(AFCRL-64-2; AD-430985)

An observed change in the resistivity of a metal caused by electron bombardment can only be interpreted quantitatively after certain corrections have been applied to account for unavoidable experimental complications. Three of the major corrections that must be applied in such experiments are discussed, methods are developed for calculating their values, and graphs of numerical values are presented. The three corrections considered are: (1) the energy correction to account for the energy distribution of the bombarding electrons, (2) the scattering correction to account for the zigzag path of the electrons through the sample, and (3) the surface correction to account for the influence of the sample surfaces on the measured resistivity. Author

N64-16871 General Precision, Inc., Pleasantville, N.Y. GPL Div.
EXPERIMENTAL MODEL OF NUCLEAR GYRO Technical Documentary Report, Apr. 1961-Apr. 1963
James H. Simpson Wright-Patterson AFB, Ohio, AF Avionics Lab., Jan. 1964 114 p refs
(Contract AF 33(616)-8329)
(ASD-TDR-63-837; AD-431727)

The feasibility model and the experimental model of the nuclear gyroscope have been operated and analyses of the gyro performance made for the purposes of determining the state-of-the-art of the nuclear gyroscope. The performance data of the experimental model indicate that a device with a potentially useful accuracy can be constructed using techniques with which the rotation information is derived from a collection of atomic nuclei. The rotation information is obtained from a comparison of the phases of the precession of the nuclei Hg^{199} and Hg^{201} in the same magnetic field as the outputs of nuclear magnetic resonance controlled oscillators. Optical-pumping techniques have been used to enhance the nuclear orientation and to monitor the precession of the nuclear magnetizations. Author

N64-16884 Bureau of Mines, Morgantown, W. Va. Morgantown Coal Research Center
CHARACTERISTICS OF POSITIVE CORONA FOR ELECTRICAL PRECIPITATION AT HIGH TEMPERATURES AND PRESSURES
C. C. Shale, W. S. Bowie, J. H. Holden, and G. R. Strimbeck 1964 21 p refs
(BM-RI-6397)

Electrical characteristics of positive corona are presented for air in a 2-in.-diam electrostatic precipitator operating under dynamic conditions at temperatures of 600° to 1,500° F and pressures of 0 to 80 psig. Results show that current–voltage relationships depend solely on air density. Comparison of data on positive corona with previously published data on negative corona demonstrates a higher spark-over voltage and a wider range of operability for positive corona at temperatures above 375° F The possibility of achieving higher voltages with positive polarity as indicated by these experiments implies several advantages for the use of positive corona in precipitators to allow better removal of suspended material from hot gases. Based on the physics of an ion in an electrical field, a theoretical equation is derived to define current–voltage characteristics of positive corona in terms of air density. Author

N64-16886 Chicago U., Ill. Lab. of Molecular Structure and Spectra
HOMONUCLEAR AND HETERONUCLEAR DIATOMIC SCF PROGRAMS, AND ATOMIC AND MOLECULAR INTEGRALS PACKAGE PROGRAM Quarterly Summary Report No. 18, 1 Oct.-31 Dec. 1963
C. C. J. Roothaan [1964] 8 p
(Contract DA-11-022-ORD-3119; ARPA Order 368)
(AD-429959)

The current program status includes the following: (1) Heavy production, using the Homonuclear and Heteronuclear Diatomic Self-Consistent Field (SCF) Programs, has continued. (2) The Numerical Atomic SCF Program has been debugged for atomic systems through beryllium. (3) The One-Center Expansion SCF Program for C_{3v} symmetry was debugged for s, p, and d Slater-type orbital expansion functions (with the principal quantum number $n \leq 9$) and for closed-shell systems. (4) The table of atomic-vector coupling coefficients for SCF calculations on all states of $sp^m d^n (0 \leq m \leq 5, 0 \leq n \leq 9)$ and for $f^n (1 \leq n \leq 13)$ open-shell configurations has been completed. (5) The calculations on diatomic molecules dominated the computation efforts. The most spectacular achievement has been the extremely accurate computations for the hydrogen molecule, including relativistic corrections and the effects of nuclear motion. For the nonadiabatic approach, extensive computations have been made for the ground and the first excited-vibrational states of H_2, D_2, and T_2. Expectation values of several operators have also been calculated for these three molecules. I.v.L.

24 PHYSICS, PLASMA

Includes fusion; and magnetohydrodynamics. *For related information see*: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N64-16345 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXAMINATION OF PULSE DISCHARGE AT LOW PRESSURE BY PROBING METHOD
B. N. Gul'ko 26 Oct. 1962 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz., (Tomsk), no. 1, 1960 p 197–202
(FTD-TT-62-1282/1+2; AD-292228)

The pulsed discharge in argon was studied. The dependence of electron temperature and electron concentration on pressure and current strength was investigated, and the nature of processes occurring in the discharge is discussed. R.T.K.

N64-16392 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE THEORY OF A MAGNETOGASDYNAMIC GENERATOR
M. I. Kiselev 26 Sep. 1962 11 p refs Transl. into ENGLISH from Vestn. Mosk. Univ. (Moscow), no. 1, 1962 p 63–68
(FTD-TT-62-1181/1+2+4; AD-292226)

The effect of the channel contours of a magnetogasdynamic generator on the efficiency of the conversion of thermal energy into electrical energy and on the dimensions of the generator is investigated. The order of the efficiency in the case of small magnetic Reynolds numbers in the supersonic region is indicated, and a method of estimating the efficiency for $Re \geq 1$ is given. Viscosity and heat conduction are neglected. Author

N64-16440 Ohio State U. Research Foundation, Columbus Antenna Lab.
TEST DURATION MEASUREMENTS IN AN ARC-DRIVEN HYPERVELOCITY SHOCK TUBE
Bruce C. Graber and Robert M. Nerem 15 Oct. 1963 33 p refs
(Contract AF 33(657)-10523)
(Rept. 1573-2; AD-423711)

Experimental data on the test duration in a 4-in.-diam. arc-driven hypervelocity shock tube are presented for a range of shock velocities from 9,000 to 41,600 fps and at initial driven tube pressures of 1 and 0.2 mm Hg. The techniques used to determine the test duration were: Schlieren photography, the measurement of optical radiative emission using photomultipliers, and microwave measurements. These results are compared with an approximate expression for test duration, which has been obtained through a correlation of results based on the theory of Roshko. The measured test durations are less than those predicted by theory. However, adequate testing periods of 10 μsec or more are attainable for shock Mach numbers as high as 30. Author

N64-16445 Aerospace Corp., El Segundo, Calif.
EFFECTS OF NON-GREY RADIATION ON WAVE PROPAGATION IN A SIMPLE DISSOCIATING GAS
Inge L. Ryhming 13 Jan. 1964 102 p refs Submitted for Publication
(Contract AF 04(695)-269)
(SSD-TDR-63-355; TDR-269(4230-20)-2; AD-430650)

Based on current knowledge of absorption spectra for diatomic gases, a theory is developed that accounts for the nongrey radiation in the flow of a nonviscous, simple dissociating gas. The propagation of acoustic waves in such a gas is studied, and the simultaneous effects of nongrey radiation and relaxation on the waves is investigated. The basic acoustic equation governing the motion of the waves is derived in general form. This equation is an integro-differential equation, which can be solved exactly for monochromatic waves in an infinite medium. The solution shows the appearance of two waves; one is essentially the classical wave, whereas the other is a radiation-induced wave that possesses no classical counterpart. Author

N64-16463 General Electric Co., Philadelphia, Pa. Space Sciences Lab.
LINEARIZED ANALYSIS OF MHD GENERATOR FLOW STABILITY
George W. Sutton and Erik Witalis Jan. 1964 16 p refs
(Contract AF 49(638)-914)
(R64SD5; AD-429173)

The quasi one-dimensional compressible flow equations for a magnetohydrodynamic power generator were analyzed for one-dimensional instabilities by means of linearized perturbations. The gas was assumed to be ideally compressible, inviscid, non-heat-conducting, with an electrical conductivity that depends on local temperature. The results indicate that large instabilities cannot exist. Author

N64-16562 Princeton U., N.J. Plasma Physics Lab.
THE BREAKDOWN OF He IN A STELLARATOR BY MEANS OF LARGE AMPLITUDE MAGNETIC PUMPING
J. Dawson, C. Oberman, and R. Kulsrud Aug. 1963 26 p refs
(Contract AT(30-1)-1238)
(MATT-211)

A Monte Carlo method was used to investigate the early stage of ionization of neutral helium, as produced by large amplitude magnetic pumping in a stellarator. The competing processes considered were: ionization, excitation, elastic scattering, and electron diffusion in and out of the pumping region. The e-folding time, τ_e, for the electron density was computed for various values of the modulation M (ratio of pumping field to static confining field), mirror ratio R (ratio of the static field in the tube to its value in the pumping region), and neutral density n_0. Other pertinent parameters were the pumping frequency ν, length of pumping region l, the remaining machine length L. These were for the most part confined to values concordant with those of the B-2 stellarator (ν = 200kc, L = 50 cm, L = 500 cm). Author

N64-16601 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF A FLOW IN A DISCHARGE ARRANGEMENT
V. N. Gusev *In its* Eng. J. (Selected Articles) 20 Jun. 1963 p 18–27 refs (See N64-16598 08-23)

A discharge arrangement is described in which a shock wave, arising as a result of the release of electrical energy, propagates into a rectilinear channel of constant cross section and compresses the working gas, thereby setting it into motion. Equations are obtained that describe the velocity, density, and pressure in the disturbed region bounded by the shock wave and the boundary of the propelling column of gas that is heated as a result of the discharge. R.T.K.

N64-16615 California U., Berkeley Inst. of Engineering Research
MODES OF OPERATION OF CONFINED KW D.C. ARGON JETS IN HELIUM OR ARGON
R. M. Mc Hale (M.S. Thesis) 30 Jan. 1964 61 p refs
(Contract AF 49(638)-502; Contract Nonr-222(45))
(AS-64-2; AD-431629)

The results indicate the following: (1) The change in appearance of the plasma jet as flow rate is increased is assumed to be due to electrical conduction through the gas switching from a uniform discharge at low flows (smooth jet) to a concentrated arc positive column at higher flows (rough jet). (2) The rough flow jet is perturbed by the continual motion of the arc column, causing a more or less thermodynamic disruption of the stream. (3) Reynolds numbers are too low to justify the jet transition on a purely fluid mechanical stability foundation. (4) It is believed that transition is primarily due to a decrease in ion mobility caused by lowering the temperature and/or increasing the pressure. The data obtained from the magnetic triggering of the transition seem to strengthen the diffusion (or drift) mobility argument. (5) Argon and helium undergo the same transition, but, due to fundamental differences in arc characteristics, their electrical behavior is not identical. R.T.K.

N64-16665 Princeton U., N.J. Plasma Physics Lab.
ON THE PRODUCTION OF AN ENERGETIC PLASMA BY MEANS OF HIGH ENERGY, SHORT DURATION LASER PULSES
John M. Dawson 18 Sep. 1963 24 p refs
(Contract AT(30-1)-1238)
(MATT-222)

Calculations are presented that show that a laser pulse delivering powers of the order of 10^{10} watts to a liquid or solid particle with dimensions of the order of 10^{-2} cm will produce a hot plasma with temperatures in the range of several hundreds of ev. To a large extent, the plasma temperature is held down by its rapid expansion and cooling. This converts much of the energy supplied into ordered energy of expansion. This ordered expansion energy can amount to several Kev per ion. If the expanding plasma can be caught in a magnetic field and its ordered motion can be converted to random motion, this might be utilized as a means for filling controlled thermonuclear fusion devices with hot plasma. Author

N64-16686* Science for industry, Inc., Brookline, Mass.
SOME NEW ASPECTS OF MAGNETO-HYDRODYNAMIC PHENOMENA
John Carstoiu Repr. from the book "Relativistic Fluid Mechanics and Magnetohydrodynamics" N.Y., Academic, 1963 p 125–177 refs Presented in Part at the Magneto-Fluid Dyn. Seminar, N.Y., 8 Mar. 1961 and at Paris U., 6 Jun. 1961
(NASA Contract NASr-18)

The topics discussed include: (1) magnetic field–fluid dynamical analogies—the basic equations of magnetohydrodynamics, the equation of motion for the magnetic field, the Elasasser–Carstoiu theorem, rigid rotation of material, the analogy of the Clebsch transformation, Hamilton's form of the equation of motion for the magnetic field, the analog of the Wever transformation , the analog of the Cauchy equations and conservation theorems, nonconservation of the current density, a new pseudotensor derived from the magnetic field; (2) magnetohydrodynamic waves in a compressible fluid—the case of an incompressible fluid, compressible fluid, wave-motion equation for the hydrodynamic density, wave-motion equations for the transverse components, general coupling relations between vorticity and current density, wave-motion equations for the rate of deformation, plane-wave solutions and wave-number surface, compressibility and effect on velocity and magnetic field; and (3) dissipative effects in magnetohydrodynamic wave—electrical conductivity, and the combined effects of finite electrical conductivity and viscosity. R.T.K.

N64-16707* Thompson Ramo Wooldridge Inc., Cleveland, Ohio TAPCO Div.
RESEARCH ON THE VORTEX MHD POWER GENERATOR
Third Quarterly Progress Report
W. C. Davis et al Jan. 1963 13 p
(NASA Contract NAS3-2526)
(NASA CR-55830; ER-5212) OTS: $1.60 ph, $0.80 mf

The experimental model of the vortex MHD generator and its auxiliary apparatus, including instrumentation, have been prepared for initial testing and evaluation. A device for seeding the plasma by atomizing and injecting cesium hydroxide into the arc-heated argon was developed. A gas dilution calorimeter was constructed for the purpose of determining enthalpy levels of the plasma supplied to and discharging from the vortex generator. Its operation was successful in a trial test. The water-cooled copper nozzles developed for the vortex generator were operated under maximum power conditions and were discharged into the atmosphere. No deterioration of the nozzles was evidenced, and the operation otherwise appeared satisfactory. Instrumentation for the vortex flow apparatus was completed. Author

N64-16776 Stanford U., Calif. Microwave Lab.
MEASUREMENT OF FIELDS IN THE PLASMA SHEATH BY AN ELECTRON BEAM PROBING TECHNIQUE
R. Harp and G. S. Kino Wright-Patterson AFB, Ohio, Aerospace Res. Labs., Jan. 1964 23 p refs
(Contract AF 33(616)-8121)
(ARL 64-14; AD-431861)

An experiment to measure both RF and d.c. fields in the sheath is described. The fields are determined by finding the deflection of an electron beam passed parallel to the sheath–plasma interface. The sheath in which these experiments were done was formed in a low-density plasma on a metal plate inserted into the plasma. Both the d.c.-field variation and the RF-field variation through the sheath when an RF potential was applied to the plate were measured. The d.c.-field variation is in good agreement with a theory by Self; the measured RF-field variations are in good agreement with a theory given by Pavkovich. No self-oscillations of any kind were measured in the sheath. This is thought to be due to a good Maxwellian distribution of electron velocities obtained by careful design of the discharge electrodes. Author

N64-16777 Stanford U., Calif. Microwave Lab.
RF BEHAVIOR OF THE PLASMA SHEATH
J. Pavkovich and G. S. Kino Wright-Patterson AFB, Ohio, Aerospace Res. Lab., Jan. 1964 22 p refs
(Contract AF 33(616)-8121)
(ARL 64-15; AD-431855)

A theoretical treatment for the variation of RF fields within the sheath is given. The analysis is based on an integration of the collisionless Boltzmann equation, with the assumption that the static potential varies parabolically in the sheath. It is shown that an effective impedance for the sheath can be defined, and that over the range in which the numerical results have been calculated, this impedance always has a real positive part. The real part of this impedance is associated with Landau damping. A set of curves is given of the field through the sheath. Author

N64-16794 Stanford U., Calif. Microwave Lab.
EXACT SOLUTION OF THE COLLISIONLESS PLASMA-SHEATH EQUATION
S. A. Self Wright-Patterson AFB, Ohio, Aerospace Res. Labs., Jan. 1964 30 p refs
(Contract AF 33(616)-8121)
(ARL 64-13; AD-431860)

Numerical solutions are presented for various values of the parameter α, which is of the order of the ratio of the Debye length to the discharge width for $10^{-3} \leq \alpha \leq 10^{-1}$, and for three assumptions regarding the ion generation rate—generation uniform, proportional to electron density, and proportional to the square of electron density. For the higher values of α, corresponding to weak laboratory discharges, there is a smooth transition from a quasi-neutral plasma region to a thick sheath. At the smaller values of α, the conventional model of a quasi-neutral plasma region passing rather abruptly into a narrow sheath region is substantiated. In all cases, accurate values for the potential profile throughout the plasma and sheath regions are given and are compared with the separate asymptotic plasma and sheath solutions for $\alpha = 0$. The ion current density, wall potential, space-charge density, mean ion energy, and sheath thickness are discussed. Author

N64-16795 Stanford U., Calif. Microwave Lab.
NUMERICAL CALCULATIONS RELATED TO THE RF PROPERTIES OF THE PLASMA SHEATH
J. M. Pavkovich Wright-Patterson AFB, Ohio, Aerospace Res. Labs., Jan. 1964 184 p refs
(Contract AF 33(616)-8121)
(ARL 64-17; AD-431854)

A detailed RF theory of the sheath is presented. The complete collisionless Boltzmann equation is used to derive a linear integral equation for the RF electric field through the sheath; the analysis is one dimensional. This integral equation is solved numerically for a semi-infinite uniform plasma bounded by a sheath defined by a parabolic d.c. potential. A Maxwellian distribution of velocities is assumed for all computations. The results show that it is reasonable to assume that the normal component of displacement is continuous, but that extra waves are set up near the boundary, which decay as the uniform plasma is approached. These waves are somewhat like the cutoff waves excited in the neighborhood of a waveguide discontinuity, and thus give rise to a sheath impedance. Author

N64-16815 Michigan U., Ann Arbor
FUNDAMENTAL CONSIDERATIONS IN THE DESIGN OF AN AC ARC HEATER [Interim Technical Report]
Richard L. Phillips Wright-Patterson AFB, Ohio, Aerospace Res. Labs., Jan. 1964 37 p refs
(Contract AF 33(657)-8630)
(ARL-64-9; AD-431185)

Certain design criteria fundamental to the successful operation of an a.c. arc-heater facility are discussed in some detail. An approximate model of a cooled metallic electrode that is heated by a moving arc is analyzed, allowing observation of the combination of parameters that affect electrode lifetime. The behavior of a three-phase inductive circuit containing arcs is studied assuming a temporal square wave arc voltage variation. It is shown that predictions of power factor, maximum useful power, RMS current, etc., can be made if only the ratio of the arc voltage to the peak line voltage is known. Author

N64-16866 Avco-Everett Research Lab., Everett, Mass.
EFFECT OF ELECTRODE NONUNIFORMITIES ALONG THE MAGNETIC FIELD IN MHD GENERATORS
Frank J. Fishman, Jr. Nov. 1963 18 p refs
(Contract AF 04(694)-414)
(Avco-Everett Res. Rept.-176; BSD-TDR-63-248; AD-431895)

The current distribution in an MHD channel with a working fluid characterized by a tensor electrical conductivity is computed for electrodes that are finely segmented in the flow direction but do not extend entirely across the channel. Fundamentally, this electrode geometry increases the normal internal impedance of the channel by an amount that is proportional to the aspect ratio of the channel, the quantity $[1 + (\omega\tau)^2]^{1/2}$, and a factor that increases monotonically with the ratio of

channel width to electrode width. The circuit characteristics and the efficiency characteristics of both normal current generators and Hall current generators based on this channel are worked out. The effects of electrodes segmented coarsely in the magnetic field direction, but finely along the flow, are deduced from the fundamental solution. A comparison with the effects of coarse segmentation along the flow indicates that these latter nonuniformities may be more than four times as effective in increasing the channel impedance. Author

25 PHYSICS, SOLID-STATE

Includes semiconductor theory; and masers. *For related information see*: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N64-16121 Joint Publications Research Service, Washington, D.C.
DISLOCATION STUDIES
4 Mar. 1964 32 p refs Transl. from RUSSIAN into ENGLISH of 3 articles
(JPRS-23509; OTS-64-21709) OTS: $1.00

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2. KINETIC THEORY OF DISLOCATIONS N. S. Akulov p 8–15 refs (See N64-16123 08-25)
3. DISLOCATION THEORY OF BRITTLE FRACTURE V. I. Trefilov p 16–29 refs (See N64-16124 08-25)

N64-16122 Joint Publications Research Service, Washington, D.C.
CRYSTAL LATTICE STATE AND DISLOCATION DENSITY IN AUSTENITE AND FERRITE DURING PHASE TRANSFORMATIONS
L. I. Mirkin and Ya. S. Umanskiy *In its* Dislocation Studies 4 Mar. 1964 p 1–7 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii. Fiz. (Tomsk), no. 3, 1960 p 212–217 (See N64-16121 08-25) OTS: $1.00

The fine intragranular structure of brand 45 steel (0.4% C) and steel with 0.4% C and 12% Mn was investigated after quenching from the temperatures 920° to 1,200° C and tempering at 200° to 700° C. The use of a method of determining the dislocation density according to the broadening of lines on X-ray photographs was proposed for investigating the processes of heat treatment. Data were obtained on the variation of the dislocation density of austenite and ferrite during the quenching and tempering of steel. A probable dislocation mechanism was proposed for the processes that occur in the α and γ phases during quenching and tempering. Author

N64-16123 Joint Publications Research Service, Washington, D.C.
KINETIC THEORY OF DISLOCATIONS
N. S. Akulov *In its* Dislocation Studies 4 Mar. 1964 p 8–15 refs Transl. into ENGLISH from Inzhenerno-Fiz. Zh. (Minsk), v. 4, no. 2, 1961 p 70–76 (See N64-16121 08-25) OTS: $1.00

The theory of kinetic dislocations is developed, and equations are obtained for the calculation of dislocation density as a function of plastic deformation. Relationships are given for the decrement of internal friction as a function of plastic deformation. Author

N64-16124 Joint Publications Research Service, Washington, D.C.
DISLOCATION THEORY OF BRITTLE FRACTURE
V. I. Trefilov *In its* Dislocation Studies 4 Mar. 1964 p 16–29 refs Transl. into ENGLISH from Sb. Nauchn. Rabot Inst. Metallofiz., Akad. Nauk Ukr. SSR(Kiev), no. 16, 1962 p 3–15 (See N64-16121 08-25) OTS: $1.00

The solution of the equation of brittle fracture, from which the Stroh equation follows as a particular case, makes it possible to obtain an expression for the temperature of brittle breaking as a function of the deformation rate, content of impurities, grain size, and blocks of the substructure. A comparison of the expression for the cold brittleness temperature with the experimental material gives evidence of satisfactory correspondence of theory and experiment. Author

N64-16286 California U., Livermore Lawrence Radiation Lab.
A STUDY OF THE EFFECT OF ALLOYING ON THE GAMMA-PHASE STABILITY OF URANIUM USING VACUUM DIFFERENTIAL THERMAL ANALYSIS
C. A. W. Peterson and W. J. Steele 12 Nov. 1963 53 p refs (Contract W-7405-ENG-48)
(UCRL-7595) OTS: $1.25

A simple, automatic, high-temperature, high-vacuum thermal analysis apparatus based on the differential method is described. Using samples of a few grams heated and cooled over a range of 1,000° C in a vacuum of 10^{-5} torr, the phase transformations of a series of alloys of uranium with the elements molybdenum, niobium, and zirconium have been determined. By this method, the effects of the addition elements upon the gamma-phase stability of the uranium under low rates of thermal change have been recorded. It has been found that the three addition elements, molybdenum, niobium, and zirconium, rank in that order in ability to stabilize the gamma phase of uranium. Author

N64-16339 Notre Dame U., Ind.
ORDER-DISORDER TRANSFORMATION IN METALLIC ALLOYS Final Report, Jul. 1954–Jul. 1961
G. C. Kuczynski Jan. 1964 6 p refs
(Contract Nonr-439(08))
(AD-431106)

The electrical resistivity and X-ray measurements employed to study the ordering reaction in AuCu and $AuCu_3$ alloys indicated that in both alloys the transition from a disordered state to an ordered one is a first-order transformation, in which ordering proceeds by nucleation and growth. Experiments of the ordering of AuCu wires under tensile stress indicated that the rate of nucleation decreases greatly with increasing stress. In $AuCu_3$ alloys, a small amount of gold work decreases the rate of nucleation. Self-diffusion in AuCu alloys was measured by the wire-sintering technique. The apparent discontinuity of ordering rates of $AuCu_3$ alloy around the 600° C temperature of disordering indicated the possiblity of some higher order transformation involving local order. E.W.

N64-16409 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE MECHANISM OF ELECTRICAL BREAKDOWN OF SOLID DIELECTRICS IN A THIN LAYER

A. A. Vorob'yev, G. A. Vorob'yev, and V. A. Kostrygin 14 Feb. 1962 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Energ. i Avtom. (Moscow), no. 4, 1962 p 66–68
(FTD-TT-62-1927/1+2+4; AD-298654)

The discharge mechanisms of NaCl, KCl, and KBr crystals are investigated. Two mechanisms are considered—the avalanche-streamer mechanism of discharge and the multiavalanche-streamer mechanism. According to the electron avalanche mechanism the discharge time is relatively large and is a function of the cathode area. According to the multiavalanche streamer mechanism the discharge time is practically independent of the cathode area. Experimental research was carried out to verify the dependence of the discharge time. The experimental results are in agreement with the hypothesis of a multiavalanche-streamer mechanism. C.L.W.

N64-16410 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THERMONIC EMISSION OF ALLOYS OF TUNGSTEN WITH TITANIUM AND HAFNIUM AND ITS DEPENDENCE ON THE PRESSURE OF OXYGEN
B. Ch. Dyubua, A. I. Pekarev et al 17 Jul. 1963 17 p refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 7, no. 9, 1962 p 1566–1573
(FTD-MT-63-37/1+2+4; AD-418229)

The dependence of work functions of tungsten alloys with titanium and hafnium on their composition is considered. It is shown that the work function of solid solutions is smaller than the work function of pure metals. Solid solutions and chemical compounds should be considered new emitters, the properties of which are distinguished from properties of pure metals. The influence of oxygen on alloy emission is considered. Author

N64-16425 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON A NEW POSSIBLE MECHANISM OF RECOMBINATION IN SEMICONDUCTORS
M. K. Sheynkman 19 Jun. 1963 6 p ref Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 7, no. 12, 1962 p 1364–1365
(FTD-TT-63-507/1+2; AD-413122)

An explanation is presented of the mechanism of recombination in semiconductors. It is shown that in order to explain the mechanism of radiationless recombination, it is necessary to explain the transmission of the energy of the element in the act of trapping the nonbasic carrier. P.V.E.

N64-16441 Hughes Research Labs., Malibu, Calif. Quantum Physics Dept.
LASER DEVICES EXPLORATORY INVESTIGATION Interim Scientific Report No. 3, 1 Nov. 1963–31 Jan. 1964
H. V. Winston [1964] 77 p refs
(Contract AF 33(657)-11650)
(AD-429856)

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2. MATERIALS GROWTH AND SPECTROSCOPY p 25–32 refs
3. NONLINEAR OPTICAL EFFECTS p 33–47 refs
4. STIMULATED RAMAN SCATTERING AND RELATED PARAMETRIC EFFECTS. APPENDIX Robert W. Hellwarth pA-1 to A-27 refs (See N64-16442 08-23)

N64-16494 Oxford U. (Gt. Brit.) Clarendon Lab.
MAGNETIC RELAXATION IN RARE EARTH SALTS Technical Note No. 3
A. H. Cooke and E. J. Daintree 20 Sep. 1963 11 p refs
(Contract AF 61(052)-677)
(AFCRL-63-576; AD-430574)

Experiments have been made on spin-lattice relaxation in rare earth salts in the helium range of temperatures. It is found that at the lowest temperatures (at which relaxation by the "direct" one-phonon process would be expected to predominate) the relaxation time, derived from measurements by the Casimir–Du Pre low-frequency method, departs in several ways from the predictions of theory. It is shown that these features can be accounted for if allowance is made for variations of the temperature of the phonons in contact with the spin system due to a "phonon bottleneck" of the type postulated by Scott and Jeffries. Author

N64-16503 Leicester U. (Gt. Brit.)
INVESTIGATION OF CHARGE TRANSPORT AND CARRIER GENERATION IN CdS Final Technical Report No. 4, 1 Nov. 1962–30 Nov. 1963
Walter Eric Spear Nov. 1963 56 p refs
(Contract DA-91-591-EUC-2735)
(E-745-P; AD-426141)

This report deals, for the most part, with an investigation of the electron transport in CdS crystals and the relation to the green-edge emission. Results of the investigation are: The rapid decrease of the luminescent intensity I_L above 90° K was confirmed and can be represented by $I_L \propto \exp(\epsilon_L/kt)$. It is suggested that, in this temperature range, to 0.15-ev center remains almost completely occupied with electrons. The free-electron density n shows a supralinear dependence on excitation intensity at higher excitation levels and decreases with increasing T in most crystals studied. This behavior is consistent with the presence of a class II center ($S_n << S_p$) lying between 0.13 and 0.15 ev above the upper valence band. The fitting of these results to a three-center model, used by Bube, led to the conclusion that: (1) The edge emission is associated with the recombination of a free electron and a trapped hole. (2) Unless the 0.15-ev center observed in these transport experiments possesses fundamentally different properties at lower temperatures, it is not connected with the luminescent process. Also discussed are preliminary work on the valence bands in CdS and an investigation of the carrier generation in CdS by soft X-rays in the 8- to 10-au range. I.v.L

N64-16594 Raytheon Co., Waltham, Mass. Research Div.
DEVELOPMENT OF AN ULTRA-HIGH TEMPERATURE PYROLYTIC GRAPHITE THERMOCOUPLE Technical Documentary Report, 1 Jan.–30 Jun. 1963
C. A. Klein, M. P. Lepie, W. D. Straub, and S. M. Zalar Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1964 93 p refs
(Contract AF 33(657)-10332)
(ASD-TDR-63-844; AD-431203)

Electrical and galvanomagnetic effects along the layer planes of three classes of pyrolytic graphites (heat-treated, as-deposited, and boron-doped) are investigated in the temperature range from 0° to 1,000° C. It is shown that the simple two-band model with symmetrical upper and lower π bands and zero-gap configuration provides an adequate description of the charge-transport mechanism. Theoretical evaluations of the Seebeck coefficient are performed in the framework of a formation presumed rigorous for semimetals. Critical information on the scattering parameter of pyrolytic graphite is thus deduced. Experimental Seebeck-coefficient results confirm the

main features of the analysis, in particular the type reversal that occurs in turbostratic graphites at temperatures of about 500° C. Thermocouple-design feasibility studies reveal that PGB/PG systems are capable of operation at least up to 2,800° C. Boron doping in the range close to the limit of solubility (0.5% to 1.0%) leads to optimum performances in the 2,000° C temperature range. Author

N64-16596 Aerospace Corp., El Segundo, Calif.
THE EFFECT OF TEMPERATURE AND STRAIN RATE ON THE YIELD AND FLOW STRESSES IN NIOBIUM
H. Conrad and G. A. Stone 27 Jan. 1964 38 p refs
(ATN-64(9236)-6; AD-431744) OTS: $3.60

The activation energy H, the activation volume v^*, and the frequency factor ν for the plastic deformation of niobium at low temperatures ($T < 0.25\ T_m$) were determined from the effect of temperature and strain rate on the yield and flow stresses. The values of H and v^* decreased from 0.75 ev and $55b^3$, respectively, at $\tau^* = 1\ kg/mm^2$; to 0.15 ev and $6b^3$, respectively, at $\tau^* = 30\ kg/mm^2$. The value of ν was $10^8 sec^{-1}$. The present results are in accord with the idea that the thermally activated overcoming of the Peierls–Nabarro stress is rate controlling during the deformation of the BCC metals at low temperatures. The values of the Peierls–Nabarro stress and energy, the kink energy, and the kink width derived from the present results using Seeger's theory for the nucleation of kinks are $1.5 \times 10^{-2}\mu$, $6 \times 10^{-3}\mu b^3$, $6 \times 10^{-2}\mu b^3$, and 8b, respectively, in agreement with previously derived values. Author

N64-16605 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TWO-PHASE DECOMPOSITION OF SOLID SOLUTIONS
P. I. Filimonov *In its* Contemp. Probl. of Phys. Met. 2 Jul. 1963 p 28–46 refs (See N64-16602 08-18)

The proposed mechanism of two-phase decomposition is based on the migration of boundaries between the initial matrix and the colonies of two-phase decomposition. Boundary migration is caused by a nonequilibrium concentration of vacancies, which is created by the flows of atoms of the alloy components diffusing during decomposition along these boundaries at different rates, and is determinable by their chemical coefficients of diffusion and concentration. The formation of a substructure occurs not only on the side of the initial matrix but also on the side of the growing colonies of two-phase decomposition. This explains the substantial hardening of a number of alloys owing to two-phase decomposition, and also the tendency of these alloys to overage in the absence of apparent structural changes. Author

N64-16606 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PERFECTION AND STRENGTH OF CRYSTALS
E. M. Nadgornyy *In its* Contemp. Probl. of Phys. Met. 2 Jul. 1963 p 47–69 refs (See N64-16602 08-18)

The presently available experimental data demonstrate that in a number of cases it is possible to realize the high theoretical strength of crystals calculated for an ideal crystal lattice in spite of the fact that the structure of real crystals can considerably differ from ideal. A high strength is associated with two extreme limits of the structural perfection: the absence of dislocations or a very large number of them. In the former case, which is realizable in crystal filaments, whiskers, and in large dislocation-free crystals, the condition of the surface is an important factor. Only a combination of both factors, perfection of the internal structure and perfection of the surface, can produce a high strength. In the latter case, where numerous dislocations or their special arrangement hinder movement of the dislocations and increases the yield point and strength, the condition of the surface is probably a less important factor. Author

N64-16644 General Electric Co., Syracuse, N.Y.
SEMICONDUCTOR LASER AMPLIFIER TECHNIQUES (SEMLAM)
Griffiss AFB, N.Y. RADC, Jan. 1964 26 p
(Contract AF 30(602)-3111)
(RADC-TDR-63-553; AD-430340)

The construction of a cryogenic dewar was accomplished, including the design of the jig to hold diodes, special pulse circuits to provide proper current pulse to the diode, the construction of an oxygen gas laser, and measurement data on tungsten package GaAs CW diodes. Author

N64-16646 General Dynamics Corp., San Diego, Calif. General Atomic Div.
THE EFFECTS OF PULSED GAMMA RADIATION ON DYNAMIC ELECTRONIC COMPONENTS Final Report, 15 Oct. 1962–19 Jan. 1964
V. A. J. van Lint, H. Horiye, D. K. Nichols, R. A. Poll, and B. W. Roos Kirtland AFB, N. Mex., AF Weapons Lab., Jan. 1964 224 p refs
(Contract AF 29(601)-5685; ARPA Order 307-62)
(GA-4062; RTD-TDR-63-3110; AD-430122)

A digital computer program has been partially formulated to take the fundamental equations that describe carrier generation, recombination, drift, and diffusion in a semiconductor device and solve them for a planar p-n junction device subjected to an initial intense pulse of ionizing radiation. Experimental measurements were performed, utilizing ionization pulses as low as 0.1 μsec in length and having peak intensities up to 10^9 r/sec, to study the behavior of germanium and silicon diodes and transistors, a germanium tunnel diode, and some representative monolithic integrated-logic gate and flip-flop circuits. These experiments were designed to facilitate comparison with the computer predictions when available. The correlation between transient radiation effects produced by high-energy electrons, fission spectrum photons, and 600 kvp X-rays has also been investigated theoretically and experimentally. Author

N64-16659 Republic Aviation Corp., Farmingdale, N.Y.
INVESTIGATION OF THE BASIC MECHANISM OF METAL FATIGUE Quarterly Engineering Progress Report No. 2, 1 Oct.–31 Dec. 1963
Barry Z. Hyatt and Louis J. Teutonico 23 Jan. 1964 38 p refs
(Contract NOw-63-0704-c)
(RAC-921-2; AD-429004)

Improved methods were devised for electrochemical cutting and chemical polishing of single-crystal copper test specimens. The mechanical loading system designed for the cyclic deformation of single crystals was calibrated, and the reliability of strain measurements was determined. Measurements were made of the attenuation of longitudinal waves propagating through <110> oriented single crystals of copper during cyclic deformation. Author

N64-16685* Rice U., Houston, Tex.
THE CRYSTAL STRUCTURE OF STRONTIUM BROMIDE
Ronald L. Sass, Thomas E. Brackett, and Elizabeth Brackett Repr. from J. Phys. Chem., v. 67, Dec. 1963 p 2862–2863 refs (NASA Grant NsG-6-59)

The crystalline state of strontium bromide was studied, using powder X-ray-diffraction techniques, in order to clarify its structural properties. By assuming that $SrBr_2$ and α-US_2 are structurally related, and that the apparent difference in the space groups is due to the anion contribution, the approximate bromine atom positions have ben deduced. IAA

N64-16687* Rice U., Houston, Tex.
THE CRYSTAL STRUCTURE OF LEAD CHLORIDE
Ronald L. Sass, E. B. Brackett, and T. E. Brackett Repr. from J. of Phys. Chem., v. 67, 1963 p 2863 refs
(NASA Grant NsG-6-59; Grant AT-(40-1)-1825)

The crystal structure of lead chloride was investigated in order to obtain a more reliable set of interatomic distances for compounds of this type. Single-crystal and powder X-ray-diffraction techniques were used for the study. The atomic parameters and the interatomic distances in $PbCl_2$ are tabulated. IAA

N64-16711* Hughes Aircraft Co., Culver City, Calif.
STUDY ON OPTICAL COMMUNICATIONS FROM DEEP SPACE Interim Progress Report, 7 Jan.-1 Feb. 1963
Kenneth L. Brinkman 1963 50 p refs
(NASA Contract NAS9-879)
(NASA CR-55814; SSD-3101S) OTS: $4.60 ph, $1.70 mf

A preliminary survey of operating lasers and their characteristics is presented. Particular emphasis is placed upon CW operating lasers (solid state and gas), the properties of the gallium arsenide lasers, and solar pumped lasers. The characteristics of operating lasers that are relevant to their use as optical communications systems components is also discussed. Bibliographies on the following subjects are presented: laser materials and devices; modes and optical properties of laser emission; modulation, mixing, detection, etc.; and theory, pumping, and miscellaneous considerations. P.V.E.

N64-16739* Virginia U., Charlottesville Research Labs. for the Engineering Sciences
A STUDY OF THIN FILM VACUUM DEPOSITED JUNCTIONS [First] Annual Status Report [5 Dec. 1962-5 Dec. 1963]
Robert L. Ramey Jan. 1964 31 p refs
(NASA Grant NsG-340)
(NASA CR-53102; EE-4012-101-64U) OTS: $3.60 ph, $1.13 mf

A summary is presented of activities carried out in order to develop the accuracy of film deposition equipment and to evaluate and calibrate the equipment. Film preparation equipment has been developed that is capable of producing a film of any preselected thickness with an indicated accuracy of about ±5 percent and with deposition rates from 0.1 to 10 A/sec. Film preparation control instrumentation is discussed and includes the following: ionization gage emission regulator; molecular beam modulator; ionization gage preamplifier; film thickness computer; source filament supply; and source regulation. P.V.E.

N64-16744* Massachusetts Inst. of Tech., Cambridge
RAMAN AND PHONON MASERS
R. Y. Chiao, E. Garmire, and C. H. Townes [1963] 29 p refs Lecture presented at Summer School Session of the Intern. School of Phys. "Enrico Fermi", Verenna, Italy, Aug. 1963
(NASA Grant NsG-330)
(NASA CR-53103) OTS: $2.60 ph, $1.07 mf

When the very intense beams of light generated by optical masers interact with matter, they tend to excite various degrees of freedom of both the matter and the radiation field, and sometimes such excitations are quite large. At certain threshold intensities, instabilities set in that transfer energy very rapidly from the beam to other electromagnetic or mechanical modes of the system. Some of these processes are discussed. The generation of coherent molecular oscillations or phonons by interaction between intense maser beams and matter is discussed in detail. The instabilities produce the observed intense Raman radiation, along with coherent molecular vibrations. The possibility that they also lead to generation of intense high-frequency sound waves and infrared radiation was also investigated. R.T.K.

N64-16760* California U., Santa Barbara
REFLECTIVITY OF SOLIDS IN THE VACUUM ULTRAVIOLET
John Osantowski (M.A. Thesis) May 1963 52 p refs
(NASA Grant NsG-91-60)
(NASA CR-53114) OTS: $5.60 ph, $1.76 mf

Peaks observed in the reflection spectrum of several solids beyond the fundamental absorption edge have been attributed to direct interband transitions at symmetry points in the Brillouin zone. In this work, a special vacuum reflectometer was constructed, and the reflectivity of cubic single-crystal zinc sulphide was measured between 4 and 30 ev. Prominent reflectivity peaks were observed at 5.9, 7.2, 9.8, and 13.8 ev. The first three peaks were tentatively attributed to the $\Lambda_3 \rightarrow \Lambda_1$, $\Sigma_4 \rightarrow \Sigma_1$, and $L_3 \rightarrow L_3$ transitions, respectively. This assignment was made by comparing the reflectivity of zinc sulphide with similar data and electron energy band calculations for germanium. The peak at 13.8 ev was attributed to a transition from the d-band, and this excitation energy was found to compare favorably with that obtained for zinc selenide. Author

N64-16774 Lincoln Lab., Mass. Inst. of Tech., Lexington
SOLID STATE QUARTERLY PROGRESS REPORT, DIVISION 8 [1 Oct.-31 Dec. 1963]
Benjamin Lax et al 6 Feb. 1964 17 p refs Prepared for Electron. Systems Div.
(Contract AF 19(628)-500)
(ESD-TDR-64-15; AD-429866)

Activities are reported in the following areas: (1) solid-state device research; (2) laser research; (3) materials research; (4) band structure and spectroscopy of solids; and (5) magnetism and resonance. R.T.K.

N64-16801 ManLabs, Inc., Cambridge, Mass. Research Div.
THERMODYNAMICS OF INTERSTITIAL SOLID SOLUTIONS AND REFRACTORY COMPOUNDS Technical Documentary Report, Sep. 1962-Sep. 1963
Larry Kaufman, Harold Bernstein, and Ann Sarney Wright-Patterson AFB, Ohio, AF Mater. Lab., Nov. 1963 96 p refs
(Contract AF 33(657)-9826)
(ASD-TR-61-445, Pt. 3; AD-431313)

The thermodynamics of interstitial solid solutions and nonstoichiometric compounds have been applied to analyses of the Ti-C, Zr-C, Hf-C, Nb-C, Ta-C, Ti-O, Zr-O, Ti-N, and Zr-N systems. The thermodynamic framework, based on the Schottky-Wagner model for nonstoichiometric phases has been applied to predict phase equilibria and vaporization data for these systems. Comparison with experimental thermodynamic, vapor pressure, and equilibria data available in the literature is very satisfactory. In addition, correlation, where possible, between thermodynamic properties and vacancy concentration data yields good agreement. Results of X-ray

measurements of the expansion coefficients and Debye temperatures of ZrC and HfC performed over the temperature range 25° to 1,500° C are also presented. Author

N64-16834 Columbia Radiation Lab., New York, N.Y.
THE OPTICAL MASER APPLIED TO BRILLOUIN SCATTERING SPECTROSCOPY Progress Report No. 2, 1 Apr. 1963-30 Sep. 1963
H. Cummins N. Knable, Y. Yeh, L. Gampel, and J. Barrett Sep. 1963 3 p refs
(Grant DA-ARO(D)-31-124-G380; NSF Grant GP-438)
(AD-432142)

Progress is reported as follows: The apparatus was considerably refined, and heterodyning efficiencies approaching the theoretical maximum were obtained. The ultrasonic tank employed in measuring Bragg-scattering frequency shifts was permanently incorporated into the apparatus as a means of displacing the frequency of the optical local oscillator beam, thereby permitting single-sideband detection at a convenient frequency. Additional improvements of the radiofrequency detection circuitry were executed, which now permit spectral scans with continuously variable resolution between 6 and 6,000 cps. J.E.T.

N64-16847 Alabama U., University
STUDIES OF SOLIDS AT LOW TEMPERATURES Final Technical Report
W. E. Hughes et al (M.S. Thesis) 8 Apr. 1963 25 p refs
(AF AFOSR Grant 61-43)
(AD-432140) OTS: $2.60

The following topics are discussed: (1) Electron Spin Resonance (ESR) of X-irradiated KH_2PO_4 and KD_2 and PO_4; (2) ESR of X-irradiated Rochelle Salt; (3) frequency shifts of Cl^{35} pure quadrupole resonance in $NaClO_3$ at low temperatures; and (4) spin-lattice relaxation of ^{79}Br and ^{81}Br in $NaBrO_3$. R.T.K.

N64-16868 Lincoln Lab., Mass. Inst. of Tech., Lexington, Mass.
SOLID STATE RESEARCH, 1963
R. J. Arnott et al 26 Dec. 1963 73 p refs
(Contract AF 9(628)-500)
(ESD-TDR-63-584; AD-427340)

Among the achievements summarized are: (1) InSb diode lasers, which emit coherent radiation at 5.2μ, have been fabricated. (2) A relatively large (~1 × 1/2 × 1/4 in.) completely single crystal of n-type ($In_{0.8}Ga_{0.2}$) has been grown from the vapor phase. Injection lasers have been fabricated from this crystal. (3) A GaAs infrared radar has been operated. (4) The problem of coherent Stokes and anti-Stokes radiation, associated with stimulated Raman emission from nitrobenzene, has been analyzed. (5) Measurements of the Seebeck coefficient (α) and resistivity (ρ) have been made as a function of temperature on doped single crystals of SnO_2. (6) The structure of the high-pressure phase of SnTe has been determined by X-ray diffraction measurements made at pressures above the transformation pressure of 18 kbar. (7) A new method for deriving a reduced Liouville equation for a subsystem from the Liouville equation of the total system has been obtained. (8) Very satisfactory agreement between theory (theory of complex spin configurations found in cubic spinels possessing relatively strong B-B interactions) and experiment have been obtained in the case of several Cr spinels. I.v.L.

N64-16873 Massachusetts Inst. of Tech., Cambridge
KOSSEL STUDIES OF IRON WHISKERS Technical Documentary Report, 15 May 1962-14 Oct. 1963
William G. Morris and R. E. Ogilvie Wright-Patterson AFB, Ohio, AF Materials Lab., Jan. 1964 33 p refs
(Contract AF 33(657)-8906)
(RTD-TDR-63-4198; AD-431193)

The application of Kossel line techniques to the crystallographic study of filamentary growths of iron has been demonstrated. The ability to investigate very small regions of a crystal lattice has proved to be extremely advantageous, since this allows detailed study of different portions along the axis of an iron whisker. Thermal gradients, which are the result of heating by the electron beam used to excite the X-ray source, can be detrimental to obtaining good patterns from whiskers less than 5 microns in thickness. The majority of the whiskers studied were α iron with a [111] direction coinciding with the whisker axis. A lattice parameter of 2.8671 ±0.0004 A was calculated for these whiskers, and their crystal lattice appeared highly perfect. Other α iron whiskers with different orientations were investigated, some of which exhibited growth kinks. Fe_3O_4 and α iron whiskers were found in the same boat on one occasion. Author

26 PROPELLANTS AND COMBUSTION

Includes fuels; igniters; and oxidizers. *For related information see*: 07 Chemistry; and 27 Propulsion.

N64-16230 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COMBUSTION AT LOWERED PRESSURES AND SOME PROBLEMS IN THE STABILIZATION OF A FLAME IN SINGLE-PHASE AND DOUBLE-PHASE SYSTEMS
7 Nov. 1962 48 p refs Transl. into ENGLISH of 2 articles from "Goreniye pri ponizhennykh davleniyakh i nekotoryye voprosy stabilizatsii plameni v odnofaznykh i dvukhfaznykh sistemakh", Moscow, AN SSSR, 1960 p 24-42, 71-85
(FTD-TT-62-948/1+2+4; AD-292190)

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1. THE INFLUENCE OF REDUCED PRESSURE ON FLAME PROPAGATION AND THE COMBUSTION ZONE IN TURBULENT FLOW S. A. Gol'denberg p 1-25 refs (See N64-16231 08-26)

2. THE EFFECT OF PRE-VAPORIZATION ON THE COMPLETENESS AND STABILITY OF COMBUSTION OF ATOMIZED FUEL V. Ya. Basevich p 26-45 refs (See N64-16232 08-26)

N64-16231 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE INFLUENCE OF REDUCED PRESSURE ON FLAME PROPAGATION AND THE COMBUSTION ZONE IN TURBULENT FLOW
S. A. Gol'denberg *In its* Combust. at Lowered Pressures and Some Problems in the Stabilization of a Flame in Single-Phase and Double-Phase Systems 7 Nov. 1962 p 1-25 refs (See N64-16230 08-26)

Considered are the experimental laws of flame propagation in laminar and turbulent flows at reduced pressures. It follows from these laws that the determining factor is the density of the medium influencing the turbulence characteristics and the

normal flame velocity. Certain experimental data are presented on the length of the combustion zone in turbulent flow for the case of combustion of previously mixed fuel–air mixtures both at reduced pressures and with a constant excess-air coefficient, as well as at atmospheric pressure and with a varying excess-air coefficient. Author

N64-16232 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EFFECT OF PRE-VAPORIZATION ON THE COMPLETENESS AND STABILITY OF COMBUSTION OF ATOMIZED FUEL
V. Ya. Basevich *In its* Combust. at Lowered Pressures and Some Problems in the Stabilization of a Flame in Single-Phase and Double-Phase Systems 7 Nov. 1962 p 26–45 refs (See N64-16230 08-26)

The theoretical relationship of the burning velocity of the vapor and liquid phases of a fuel, assuming a free turbulent transfer of the mass to the reaction zone of burning droplets, was checked experimentally. It was found that the propagation velocities of a turbulent flame cannot serve as the basis for determining the completeness of combustion and the mass burning velocity of atomized fuel. Author

N64-16262 Gt. Brit. Ministry of Aviation, Mottingham Technical Information and Library Services
RELATIONSHIPS BETWEEN PROPERTIES AND POWER OF FUELS FOR AIR JET ENGINES [BEZIEHUNGEN ZWISCHEN EIGENSCHAFTEN UND LEISTUNGEN VON KRAFTSTOFFEN FUR LUFTSTRAHLANTRIEBE]
G. Spengler, M. Zimmer, and H. Gemperlein Dec. 1963 32 p refs Transl. into ENGLISH from Deutsche Versuchsanstalt für Luft- und Raumfahrt Report 210, 1962, Germany
(TIL/T.5460; DVL-210)

The influence of different chemicophysical data of fuels on the thrust of a small test ramjet engine is investigated. For this purpose, a number of characteristics particularly influencing the preparation of the fuel have been combined under the definition "heat of preparation" and their influence on the combustion behavior determined. A calculation method for determining the power data of jet fuels in the case of partial combustion is discussed. Author

N64-16375 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AMPLIFICATION OF SHOCK WAVES IN THEIR PASSAGE THROUGH A FLAME FRONT
G. A. Salamandra and I. K. Sevast'yanova 19 Jul. 1963 11 p refs Transl. into ENGLISH from the book "AN SSSR Energeticheskiy Institut, Fizicheskaya Gazodinamika, Teploobmen i Termodinamika Gazov Visokikh" Moscow, 1963 p 199–203
(FTD-TT-63-532/1+2; AD-415014)

The following mechanism for the amplification of a shock wave in its passage through a flame front is proposed. The shock wave, in passing through the flame front, increases the pressure and temperature in the front. With the increase in the temperature and the density in the reaction zone, there is a speeding up of the rate of the chemical reaction. Consequently, at the moment when the shock wave passes through the reaction zone, more heat will be given out in the zone than when the flame is being propagated in the combustion mixture that is not disturbed by the shock wave. These changes in the combustion zone bring about disturbances in the gas close to the flame front. Those disturbances, which are being propagated in the direction of the propagation of the shock wave and are overtaking this wave, will amplify it. I.v.L.

N64-16444 Texaco Experiment Inc., Richmond, Va.
THE COMBUSTION OF ELEMENTAL BORON WITH FLUORINE Final Report
U. V. Henderson Jr., H. P. Woods, and Genevieve Poplin 3 Feb. 1964 23 p refs Presented at AIAA Heterogeneous Combust. Conf., Palm Beach, Fla., 11–13 Dec. 1963
(Contract Nonr-1883(00))
(TEI-TP-209; EXP 223; AD-430909)

Two techniques were employed to study the reaction of boron with fluorine. The first was a microbalance apparatus in which the rate of boron reaction could be determined as a function of temperature from ambient up to about 800° K and as a function of pressure in the 0.1 to 1.0 torr range. The second procedure was to carry out the reaction on a heated boron rod inside a mass spectrometer, so as to permit detection of the species evolved from the reaction surface. On the basis of experimental evidence, it is suggested that the fluorine–boron reaction goes through several different mechanisms, depending on the temperature and pressure. R.T.K.

N64-16559 Sheffield U. (Gt. Brit.)
COMBUSTION INSTABILITY RESEARCH ON SOLID AND LIQUID PROPELLANT ROCKET MOTORS AT SHEFFIELD UNIVERSITY
J. Swithenbank Jun. 1963 25 p refs

The high-frequency tangential mode of oscillation in a premixed gaseous-fueled rocket motor of 14-in. ID was investigated. In particular, the first tangential traveling mode was studied. Theoretical and practical studies indicated that a net velocity of the gas (in the form of a vortex) is associated with this mode. The following conclusions were drawn as a result of these studies: (1) There is a difference in wave shape between traveling and standing tangential modes. (2) High-amplitude traveling modes will produce vorticity. (3) The stability will decrease if the vorticity is artificially or self-increased. (4) The vorticity will exert a torque on the motor. (5) Swirl in the nozzle will reduce the effective throat area. (6) The vorticity will reduce the frequency of oscillation. Also, research has been extended to cast double-base propellants, and experiments are being conducted to obtain a deeper understanding of the theoretical work being carried out by McClure et al at A.P.L. I.v.L.

N64-16616 Vitro Labs., Silver Spring, Md.
RESEARCH AND DEVELOPMENT OF MATERIEL ENGINEERING DESIGN HANDBOOK – BALLISTIC MISSILE SERIES, PROPULSION AND PROPELLANTS
M. J. Zucrow (Purdue U.) Washington, Army Mater. Command, Aug. 1963 102 p refs Prepared under contract for Duke U.
(AMCP-706-282)

Information is presented on the fundamental operating principles of propulsion systems as found in ballistic missiles. The following topics are discussed: (1) essential features of rocket engines; (2) criteria of rocket-engine performance; (3) thermodynamic relationships for rocket engines; (4) properties and characteristics of liquid propellants; and (5) properties and characteristics of solid propellants. R.T.K.

N64-16624 Bureau of Mines, Pittsburgh, Pa.
SENSITIVITY CHARACTERISTICS OF LIQUID EXPLOSIVE SYSTEMS Progress Report No. 8, 1 Oct.-31 Dec. 1963
Charles M. Mason and John Ribovich Jan. 1964 9 p refs
(Contract IPR-19-64-8026-WEPS)
(AD-431641)

Experimental results obtained in the research program established to evaluate the safety hazard associated with high-energy liquid explosives are discussed. The program was extended to include a study on the sensitivity of nitroglycerin casting solvents. The effect of stoichiometry on the sensitivity of the hydrogen peroxide–glycerin system to shock initiation was studied. Threshold gap values were determined for the difference between high- and low-velocity detonation. An expendable pressure transducer was investigated as a means of establishing gap testing on a more quantitative basis. R.T.K.

N64-16658 IIT Research Inst., Chicago, Ill.
A STUDY OF THE FUNDAMENTALS OF LIQUID PROPELLANT SENSITIVITY
Ted Erickson Edwards AFB, Calif., AF Flight Test Center, 10 Jan. 1964 26 p refs
(Contract AF 04(611)-9566)
(IITRI-C6024-4; AD-428841)

A cryogenic adaptation of the IITRI shock tube has been designed, and it is expected that it can be used for the testing of materials at temperatures down to −150° C. The final assembly of this modification has been started. A chromatographic column and the associated equipment are being provided for purification of the test materials before sensitivity testing.
Author

N64-16849 Douglas Aircraft Co., Inc., Newport Beach, Calif. Astropower Lab.
SOLUTION AND CONDUCTIVITY STUDIES IN FLUORINE CONTAINING LIQUID OXIDIZERS Quarterly Progress Report, 10 Sep.-10 Dec. 1963
W. D. English and W. A. Cannon [1963] 16 p
(Contract DA-31-124-ARO(D)-115; ARPA Order 470)
(Rept. 144-Q2; AD-429849)

Construction of a modified solution-study apparatus was completed. Instrumentation was acquired and calibrated.
Author

N64-16892 Aerojet-General Corp., Azusa, Calif. Von Karman Center
INVESTIGATION OF THE MECHANISMS OF DECOMPOSITION, COMBUSTION, AND DETONATION OF SOLIDS Technical Operating Report No. 16, 1 Oct.-31 Dec. 1963
J. P. Kispersky Feb. 1964 12 p refs
(Contract AF 49(638)-851; ARPA Order 24-60)
(Rept. 0372-01-16; AD-431563)

Apparent-flame-strength measurements have been made on the ammonia–chlorine system at ambient temperature and pressures ranging from 300 to 745 torr. At 1 atm, an apparent flame strength value of 1.30 g/cm^2-sec was obtained that corresponds to a volumetric rate of fuel consumption of 3.18 g/cm^3-sec and a volumetric heat release rate of 8.5 × 10^3 cal/cm^3-sec. A log-log plot of apparent flame strength versus pressure indicates that the overall reaction order for the NH_3–Cl_2 flame reaction is 2.3. The data indicate that at pressures of less than 2 atm, ammonia is oxidized more rapidly by oxygen than by chlorine.
Author

27 PROPULSION

Includes airbreathing, electric, liquid, nuclear, and solid propulsion. *For related information see*: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N64-16120* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
ANALYTICAL EVALUATION OF POSSIBLE NONCRYOGENIC PROPELLANTS FOR ELECTROTHERMAL THRUSTORS
John W. Schaefer and John Ferrante Washington, NASA, Mar. 1964 24 p refs
(NASA TN D-2253) OTS: $0.75

The theoretical performance of hydrogen and the noncryogenic gases lithium, lithium hydride, ammonia, methane, ethane, and water (as electrothermal thrustor propellants) is presented. The frozen flow performance and the thrustor-nozzle heat flux and propellant heat loss are considered. For specific impulse levels of the order of 1,000 seconds and a pressure of 1 atmosphere, hydrogen is the best propellant choice in terms of frozen flow efficiency. The other propellants have a competitive frozen flow efficiency above 1,200 seconds. The heat flux at the throat of the thrustor nozzle is smallest for hydrogen. At a given frozen specific impulse level, the noncryogenic propellants exhibit a throat heat flux as much as five times higher than that for hydrogen. The total propellant heat loss can also be expected to be smallest for hydrogen.
Author

N64-16214 France. Ministére de l'Air, Paris
CONTRIBUTIONS TO A SIMILARITY STUDY OF ROCKET MOTORS [CONTRIBUTIONS A UNE ETUDE DE SIMILITUDE POUR DES MOTEURS-FUSEES]
Wolfgang Zangl Serv. de Doc. et d'Inform. Tech. de l'Aeron. (SDIT), 1963 79 p refs In FRENCH
(*Its* Publ. Sci. et Tech. No. BST-130)

An experimental study was conducted to investigate the influence of structural parameters —such as the number of barrels in the carburetor, their diameter and distance, pressure losses, and the length of the combustion chamber, etc.—on the rocket-engine performance, particularly on the quality and stability of the combustion process and on the overheating of the engine. Correlations were made between the results obtained for various engines in the light of defining a law of similarity. Tests were conducted on complete engines having cylindrical injection systems. The nozzles had simple chamber walls and ceramic throats. The test pressures were between 2 to 15 t. The fuel used was of the gas–oil type, oil of turpentine or kerosene, with fuming nitric acid as the oxidizer.
Trans. by I.v.L.

N64-16342 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINATION OF THE TEMPERATURE FIELD AND THERMAL STRESSES OF TURBINE DISCS
N. A. Minyaylenko [1962] 91 p refs Transl. into ENGLISH of a Monograph from Kiev, Izd. AN SSR, 1960 p 3–69
(FTD-TT-62-766-1+2+4; AD-420663)

A simplified method, one that can be reduced to nomograms, is discussed for calculating temperature fields and peripheral thermal stresses in turbine rotors, cooled by radial air blasting, during starting and operating regimes. The method is applicable in the case of disc cooling by symmetrical, nonsymmetrical, complete, and incomplete blasting. The error in determining the disc temperature from the nomograms does not exceed 6% when the boundary conditions are correctly given. Using the given method, the construction of the nomograms for determining the temperature in the disc periphery (ρ = 0.9 to 1.0) can be expanded and used to determine the temperature on any radius of the disc and to determine the temperature in steam-turbine discs cooled by steam blasts. From the temperature fields, the stressed state of the turbine disc is determined.
I.v.L.

N64-16501 Thiokol Chemical Corp., Huntsville, Ala. Alpha Div.

NOZZLE EVALUATION Quarterly Interim Technical Report, Army Materials Research Agency Program, 22 Jun.-21 Sep. 1963

G. F. Mangum 24 Feb. 1964 84 p refs

(Contract DA-01-021-ORD-11919, Mod. 17)

(Rept. 9-64; AD-430753)

During this period, the Army Missile Command (AMICOM) delivered to Thiokol Chemical Corporation one Atlantic Research 2-inch pyrolytic-graphite-coated nozzle insert and two titanium boronitride Calorobic 1-inch nozzle inserts. An analytical program has been developed which contains work performed to date on methods for calculating the temperature distribution in an ablating material exposed to a time variable heat flux. The equations are derived to analyze one-dimensional heat flow in a rectangular- and cylindrical-body-oriented coordinate system with an ablating face surface, and two-dimansional heat conduction in a cylindrical coordinate system. Considerations of surface decomposition by melting, charring, and vaporizing are also presented. Author

N64-16575* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

AN ELECTRON-BOMBARDMENT ION ROCKET WITH A PERMANENT MAGNET

Paul D. Reader N.Y., Am. Inst. of Aeron. and Astronautics [1963] 8 p refs Presented at the AIAA Elec. Propulsion Conf., Colorado Springs, 11–13 Mar. 1963

(AIAA Paper-63-031) AIAA: $0.50 members, $1.00 nonmembers

A program was undertaken to determine the feasibility of utilizing a permanent magnet circuit to provide the magnetic field of the shape and strength required for the efficient operation of a low-current-density electron-bombardment ion rocket. The experimental results of the investigation are presented. The method used to design the magnetic circuitry is described. An experimental comparison of ion-camber efficiency (i.e., ev/beam ion) is made between the permanent-magnet and solenoid types. Experimental flight designs for both magnetic field systems are compared for total weight and system requirements. Author

N64-16589 Naval Research Lab., Washington, D.C. Mechanics Div.

THERMAL SHOCK EVALUATION OF REFRACTORY MATERIALS AS ROCKET NOZZLE INSERTS [Final Report]

E. W. Kammer, H. Smith, and Eugene L. Olcott (Atlantic Res. Corp.) 30 Nov. 1963 53 p refs

(Contract Nonr-3601(00)(X))

(NRL-6005; AD-430879)

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1. THERMAL SHOCK EVALUATION OF REFRACTORY MATERIALS AS ROCKET NOZZLE INSERTS E. W. Kammer, H. Smith, and E. L. Olcott (Atlantic Res. Corp.) p 1–20 refs (See N64-16590 08-27)

2. APPENDIX A: METALLURGICAL EXAMINATION OF FIRED TUNGSTEN ROCKET NOZZLE INSERTS E. L. Olcott (Atlantic Res. Corp.) p 21–25 (See N64-16591 08-27)

3. APPENDIX B: METALLURGICAL EXAMINATIONS OF TWO EXPERIMENTAL TUNGSTEN ROCKET NOZZLE INSERTS (B-1 AND B-2) R. A. Meussner and R. J. Goode p 26–40 refs (See N64-16592 08-27)

4. APPENDIX C: METALLOGRAPHIC AND FRACTURE STUDIES OF INFILTRATED TUNGSTEN INSERTS R. A. Meussner p 41–51 (See N64-16593 08-27)

N64-16590 Naval Research Lab., Washington, D.C. Mechanics Div.

THERMAL SHOCK EVALUATION OF REFRACTORY MATERIALS AS ROCKET NOZZLE INSERTS

E. W. Kammer, H. Smith, and Eugene L. Olcott (Atlantic Res. Corp.) *In its* Thermal Shock Evaluation of Refractory Mater. as Rocket Nozzle Inserts 30 Nov. 1963 p 1–20 refs (See N64-16589 08-27)

Uninfiltrated sintered tungsten of several densities, together with copper or silver infiltrated material used as rocket nozzle inserts, was examined by using a small-scale nozzle but with operational temperature, pressure, and time duration of exposure. The nozzle insert walls were notched to produce stress raisers, and their effects on the fracture patterns established relative ratings for resistance to thermal shock. Room-temperature fracture toughness factors were also determined from notched bars of these same materials. This toughness factor served as a quality rating score to order the materials in their ability to resist fracture. It was found that copper-infiltrated sintered tungsten rated highest both on the model test and on the fracture toughness scale. Mechanical strain induced in the outer surface of the nozzle insert by temperature gradients across the wall at the beginning of the ignition sequence, and the temperature were measured with the aid of several types of electrical resistance gages. These gages verified that cracking of the nozzle insert wall occurred early in the burning process. Author

N64-16591 Atlantic Research Corp., Alexandria, Va.

METALLURGICAL EXAMINATION OF FIRED TUNGSTEN ROCKET NOZZLE INSERTS

Eugene L. Olcott *In* NRL Thermal Shock Evaluation of Refractory Mater. as Rocket Nozzle Inserts 30 Nov. 1963 p 21–25 (See N64-16589 08-27)

The results obtained by metallographically examining 29 tungsten inserts are discussed. No significant changes in grain size were observed at the throat section of any of the inserts. Minor grain growth was observed on all of the inserts at the throat section where, for a depth of several grains, the smallest grain size was approximately that of the largest grains on the unaffected material. Substantial variations in microstructure occurred in any given insert. Several of the inserts showed local areas that were almost pore free. No significant tungsten reactions could be observed at the hot gas interface. P.V.E.

N64-16592 Naval Research Labs., Washington D.C. Metallurgy Div.

METALLURGICAL EXAMINATIONS OF TWO EXPERIMENTAL TUNGSTEN ROCKET NOZZLE INSERTS (B-1 AND B-2) [Interim Report]

R. A. Meussner and R. J. Goode *In its* Thermal Shock Evaluation of Refractory Mater. as Rocket Nozzle Inserts 30 Nov. 1963 p 26–40 refs (See N64-16589 08-27)

Two subscale tungsten nozzle inserts have been examined in detail. Although both displayed equally satisfactory performance in these tests, one developed a large number of circumferential cracks and the other formed only one. The structure of the heavily cracked insert showed a nonuniform distribution of porosity and a limited zone of alumina infiltration. The other was very uniform in structure and was completely infiltrated by alumina during its test. The detailed examinations of these inserts revealed that, with the exception of the extent of the circumferential cracking, both had suffered the same type of damage. Both showed pitting and cracking along the entrance surface and deep longitudinal cracks in the body of the inserts. The cracking at the pit sites has been ascribed

to contamination that resulted in hot tearing during the cooling of the parts after the tests. The longitudinal cracks, formed by thermal shock, were formed very early in the firing tests. In these small heavy-walled inserts these inherently dangerous cracks did not cause the nozzle to fail. From the mode of fracture and the extent of carburization along the circumferential cracks, it was consluded that these must form after the inserts had reached a high temperature. Author

N64-16593 Naval Research Lab., Washington, D.C. Metallurgy Div.
METALLOGRAPHIC AND FRACTURE STUDIES OF INFILTRATED TUNGSTEN INSERTS
R. A Meussner *In its* Thermal Shock Evaluation of Refractory Mater. as Rocket Nozzle Inserts 30 Nov. 1963 p 41–51 (See N64-16589 08-27)

Copper-infiltrated and silver-infiltrated specimens were studied. The performance of the copper-infiltrated tungsten specimens was superior in the thermal shock tests of the small motor firings and in the notch bend tests. The silver-infiltrated material employed in the small nozzle tests displayed an unusual cellular structure. This cellular structure may be responsible for the high incidence of laminar cracking near the inner surface of these nozzles inserts. Fracture surfaces produced at room temperature are assumed to be representative of the initial fractures occurring at the outer surface of the nozzle inserts during a test firing. Studies of these surfaces provided a model of the fracture mechanism and indicated that cracks should be more difficult in initiate and propagate in the copper than in the silver-infiltrated material. Author

N64-16660 Giannini Controls Corp., Duarte, Calif.
EXPERIMENTAL RESEARCH OF SHOCK WAVE PERTURBATIONS TO OBTAIN VEHICLE VELOCITY Final Report
J. R. Rochester Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1964 222 p refs
(Contract AF 33(616)-7764)
(RTD-TDR-63-4108; AD-428844)

High-speed laboratory-created plasmas in the range of 10^6 to 10^9ions/cc and 5×10^5 and 5×10^6cm/sec have been studied. Ion-density waves have been introduced into these plasmas by means of high-intensity pulsed magnetic fields and have been observed by mechanical, microwave, electrostatic, and optical probes. The properties governing the magnetic generations of the above-described waves have been studied by varying the magnetic geometry pulse duration, rise time, and field intensity. Comparison of the various detector probes indicates the electrostatic probe, which works on a capacitive principle, to be the apparent best choice for applications to aerodynamic hardware. The propagating perturbations have been used to determine the velocity of the high-speed plasmas, and agreement has been obtained between these measurements and velocity measurements obtained by other methods. Author

N64-16732 Federal Aviation Agency, Washington, D.C. Systems Research and Development Service
WIND TUNNEL TESTS OF TURBOPROP ENGINE CHARACTERISTICS DURING BIRD INGESTION [Final Report]
Donald M. Millar Nov. 1963 96 p refs
(FAA-ADS-2)

Performance data were obtained for operations at takeoff power and simulated airspeeds ranging from 100 to 140 knots. The engine was subjected to ingestion of 231 starlings in densities of 1, 2, 3, 4, 6, and 8 birds per test, and ingestion of 1 sea gull. The results obtained during the test program clearly indicate that multiple bird ingestions can critically affect gas turbine propulsion system operation without causing mechanical damage. An experimental ignition system configuration was evaluated to determine its effect on engine performance following loss of combustion from a multiple bird-ingestion incident. No evidence was compiled during the test program that this system would alleviate the adverse performance effects induced by a bird-ingestion incident. Author

N64-16853 Mass. Inst. of Tech., Cambridge
BASIC RESEARCH AND DEVELOPMENT IN FLUID JET MODULATORS FOR TURBOPROPULSION SYSTEM CONTROL FOR THE UNITED STATES AIR FORCE, 1 APRIL 1962-31 MARCH 1963
K. N. Reid et al 31 Mar. 1963 111 p refs
(Contract AF 33(657)-8384)
(DSR 9159-1; AD-432133) OTS: $9.60

A basic approach for a quasi-static prediction for the dynamic behavior of controlled jets is presented and is implemented by a digital computer. Experimental results of a basic investigation of the impingement of a turbulent jet onto a flat plate are given for a wide variation of Reynolds numbers and are compared with theory. The static and dynamic interactions of jets with receiver ports are discussed, including theoretical and experimental results. After a discussion of the pressure and temperature environment in which useful engine-control pressure sensors must operate, two particular approaches to the sensor problem are presented. The first is a fluid jet relay to detect large regions of relatively stagnant fluid (rotating stall cells), which can be indicative of an incipient flow instability, and the second is a blade-wake sensor based on fluid diodes coupled to volumes. Author

28 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. *For related information see*: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N64-16354 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THROUGH THE COSMOS – INTO THE MICROCOSM (METHODS AND PERSPECTIVES OF STUDYING COSMIC RAYS)
G. B. Zhdanov *In its* Sci. and Life (Selected Articles) 10 Dec. 1962 p 31–43 (See N64-16351 08-01)

Among the methods and perspectives of studying cosmic rays discussed are the following: (1) instruments onboard Soviet manmade earth satellites that are a photoemulsion instrument with automatic development of the photoemulsion; a Cherenkov counter for registering heavy nuclei for primary cosmic radiation; and an apparatus, containing scintillation counters, for studying the general intensity and energy state of ionizing radiation; (2) an ionization calorimeter, in combination with a Wilson chamber, in a magnetic field for studying nuclear reactions of higher energy; and (3) the use of large photoemulsion piles in the discovery of so-called "fire balls," peculiar clumps of highly excited matter, formed in the process of nucleon reaction at any energy over 10^{12} ev, and spatially separated from the nucleons that form these clumps. Also, physicists are working on the formulation of a theory that could

describe the reaction processes of particles, taking their structure into consideration, such as reactions of a central type (with the formation of one excited system after collision), as well as a peripheral type that is characterized by a very weak loss in the energy of the falling particle. I.v.L.

N64-16417 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A NEW BRANCH OF SCIENCE– MAGNETOHYDRODYNAMICS
Tsho Fu-Tsin 11 Jun. 1963 8 p Transl. into ENGLISH from K'o Hseuh Ta Chung (China), no. 1, 1962 p 8–9
(FTD-TT-63-207/1+2; AD-414754)

Briefly discussed are sunspots and solar storms, and various phenomena associated with them through magnetohydrodynamics. The discussion also includes the application of magnetohydrodynamics in reentry problems and its importance in the development of atomic and nuclear power. C.L.W.

N64-16474 RAND Corp., Santa Monica, Calif.
GALACTIC COSMIC RADIATION AND MANNED SPACE FLIGHT
A. R. Tamplin and H. K. Fisher Dec. 1962 33 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3043-PR; AD-292077)

A discussion of the flux and composition of primary cosmic particles of galactic origin is presented, together with a discussion of the processes through which these particles may transfer energy to biological specimens. The biological effects of primary cosmic particles are estimated on the bases of both dosage and pseudotarget theory. Both dosage estimate and the pseudotarget-theory calculations indicate that serious biological effects (including measurable damage to the nervous system) will probably not become manifest without very extended exposure times (much more than 100 days). Author

N64-16491 Liege U. (Belgium)
NOTE ON SOME CONSEQUENCES OF ALFVEN'S CONDITIONS FOR INTERPRETING THE VAN ALLEN ZONES AND THEIR MOVEMENTS AS WELL AS DISTANT AZIMUTHAL CURRENTS Technical Note No. 4
J. Lemaire 25 Oct. 1963 28 p refs
(Contract AF 61(052)-587)
(AFCRL-64-226; AD-430707)

This discussion of the conditions that limit the application of Alfvén's theory to the motion of a charged particle in a magnetic field is based on experimental and observational data on the Van Allen belts. Author

N64-16677* Princeton U. Observatory, N.J.
THE STRUCTURE OF SUNSPOT UMBRAS. I. OBSERVATIONS
Robert E. Danielson Repr. from Astrophys. J., v. 139, no. 1, Jan. 1964 p 45–47 refs
(Sponsored by NASA, NSF and ONR; Proj. Stratoscope)

High-definition photographs of a sunspot obtained by Stratoscope I show that the umbra is resolved into many tiny bright dots. These dots have diameters of 300 km or less. Their lifetime is of the order of one-half hour. Author

N64-16773* Chicago U., Ill.
DYNAMICAL PROPERTIES OF STELLAR CORONAS AND STELLAR WINDS. I. INTEGRATION OF THE MOMENTUM EQUATION
E. N. Parker Repr. from Astrophys. J., v. 139, no. 1, 1 Jan. 1964 p 72–92 refs
(NASA Grant NsG-96-60)

The hydrodynamic momentum and mass-flow equations are integrated for a stellar corona with spherical symmetry about the center of the star. The coronal temperature is taken to be a known function $T(r)$ of radial distance. The general properties of the equations are discussed, and it is shown that if the corona is tightly bound by the solar gravitational field, so that the thermal velocity is small compared to the gravitational escape velocity, and if the coronal temperature declines outward more slowly than $1/r$, then the corona is quasi-static at its base and expands to supersonic velocity in space. No alternative is available. The stellar mass loss resulting from the expansion is determined by the coronal temperature between the base of the corona and the point at which the flow becomes supersonic. The amount by which the velocity of the resulting stellar wind exceeds the thermal velocity in the corona depends principally upon the temperature beyond the point where the flow becomes supersonic. Author

29 SPACE SCIENCES

Includes space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories. *For space biology see*: 16 Life Sciences. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

N64-16247 RAND Corp., Santa Monica, Calif.
USE OF EXTRATERRESTRIAL RESOURCES FOR MARS BASING
Ernst A. Steinhoff May 1963 20 p refs Presented at the Symp. on the Exploration of Mars, Denver, 6–7 Jun. 1963
(P-2746)

Use of regeneration techniques to recover water and oxygen, and hydroponic gardening to grow food can reduce the logistics requirements to a small fraction of the original value and so reduce the cost of resupply. A further drastic reduction of space transportation costs can be achieved by using lunar and planetary resources for the local production of water, which together with its decomposition products represents over 90% of all the logistic needs of humans and which can also satisfy rocket propulsion needs for spacecraft if used in its dissociated state and liquefied form as LH_2 and LO_2. An advanced technology program is evolved in broad terms outlining areas of applied research and advanced development. Besides water, other locally produced chemical compounds suitable as fuels for spacecraft and extraterrestrial surface and flight vehicles or as nutrients for the local production of food and for the photosynthetic regeneration of oxygen are discussed. Author

N64-16260* California U., Berkeley Space Sciences Lab.
THE REFLECTION AND EMISSION OF ELECTROMAGNETIC RADIATION BY PLANETARY SURFACE AND CLOUDS
D. G. Rea and W. J. Welch Repr. from Space Sci. Rev. (Dordrecht), v. 2, 1963 p 558–617 refs
(NASA Grant NsG-101-61; NSF Grant 16741)

General considerations are presented of the theory of reflection from plane, layered, and rough surfaces, and from clouds. Principles underlying the radiometric determination of planetary temperatures are delineated. The behavior of the lunar surface in the visible region is discussed, and information obtained

about the surface from radar reflections, infrared emission, and thermal emission at radio wavelengths is considered in some detail. Visible, near infrared, infrared, passive microwave, and radar observations of Venus and Mars are reviewed. Observations of Jupiter, Saturn, and Mercury are briefly summarized. IAA

N64-16321* Naval Ordnance Lab., White Oak, Md.
R-71 PROGRAM Summary Report
L. E. Crogan 23 Dec. 1963 36 p
(NASA Order R-71)
(NASA CR-55543) OTS: $3.60 ph, $1.28 mf

A drag and stability program involving two configurations, Mariner B Shape A-1 and the JPL Configuration V-1, was conducted in a pressurized ballistics range at velocities of approximately 16,000 fps and at an ambient pressure of 90 mm Hg. The tests were conducted in air, nitrogen, and several combinations of nitrogen and carbon dioxide. The velocities were obtained with 0.50°-inch-maximum-diameter models launched from a 20 mm two-stage light-gas gun. Speed of sound values were obtained both by experiment and by calculation and, in the majority of cases, differed by less than 1%. A complete summary of the final drag and stability data is presented. The aerodynamic coefficients and derivatives are also presented in graphical form as a function of both Mach number and mean squared yaw. Included are listings of the NOL's gas chromatography analyses and the Bureau of Standard's mass spectrometric analyses. R.L.K.

N64-16397 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NATURE (SELECTED ARTICLES)
16 Nov. 1962 46 p refs Transl. into ENGLISH from Priroda (Moscow), no. 9, 1962 p 1–22
(FTD-TT-62-1546/1+2; AD-294526)

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9. NEXT FLIGHT TO THE MOON AND MARS V. G. Fesenkov p 39–40 (See N64-16401 08-29)

N64-16400 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE SECRETS OF THE UNIVERSE ARE BEING REVEALED
A. G. Masevich *In its* Nature (Selected Articles) 16 Nov. 1962 p 29–35 (See N64-16397 08-29)

Satellites and rockets have enabled researchers to go beyond the boundaries of the terrestrial atmosphere, to investigate short-wave radiations from the sun and stars (and thus to more fully reveal the nature of these heavenly bodies), and to investigate the primary components of cosmic radiation as well as the structures and physical conditions of the upper layer of the terrestrial atmosphere and near-earth space. Magnetic measurements, carried out from satellites and rockets, explained many questions relating to the origin of the main magnetic field of the earth and the source of the magnetic anomalies as well. A detailed chart of the reverse side of the moon was prepared, based on photographs taken aboard lunar rockets. Also, the flights of cosmonauts have supplied new data concerning man's ability to function in the state of weightlessness and the effect of conditions of long-lasting cosmic flight on the human organism. I.v.L.

N64-16401 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEXT FLIGHT TO THE MOON AND MARS
V. G. Fesenkov *In its* Nature (Selected Articles) 16 Nov. 1962 p 39–40 (See N64-16397 08-29)

According to the author, the U.S.S.R. is on the eve of realizing long-lasting cosmic journeys. He states that this is vividly indicated by the high perfection of the equipment of the Soviet cosmic ships, as recently demonstrated. Next on the agenda, he states, is flight to the Moon and then to Mars. However, prior to planning the trip to Mars, experiments must be conducted for finally solving the problem of whether or not molecular oxygen and water vapor exist on that planet. I.v.L.

N64-16524 Boeing Co., Seattle, Wash.
RANGE CAPABILITY OF S-IVB AND SERVICE MODULE USED AS ABORT VEHICLES FROM SATURN V BOOST TRAJECTORIES
V. V. Moore and F. G. Bourque *In* NASA. Marshall Space Flight Center Implementation Rept. No. 1 on Studies in the Fields of Space Flight and Guidance Theory 1963 p 71–88 refs (See N64-16521 08-22) OTS: $9.10 ph, $3.38 mf

The minimum and maximum range capability of the S-IVB Stage and Service Module, used as vehicles for powered abort from an expected volume of Saturn V boost trajectories, has been determined. Abort is assumed to occur between the time of second-stage ignition and a time near final lunar injection. Abort trajectories terminate at a reentry altitude of 120 km with flight path angles of 94° and 99.5° Author

N64-16525 Raytheon Co., Bedford, Mass. Space and Information Systems Div.
RE-ENTRY CORRIDOR FOR MANNED LIFTING VEHICLE
Ann Muzyka and H. Elmore Blanton *In* NASA. Marshall Space Flight Center Implementation Rept. No. 1 on Studies in the Fields of Space Flight and Guidance Theory 1963 p 89–103 refs (See N64-16521 08-22) OTS: $9.10 ph, $3.38 mf

A study has been made to determine the extreme reentry flightpath angles, for various reentry speeds, that permit safe, unpowered descent for a given manned lifting vehicle. Circular arcs, called entry arcs, were located at the initial altitude of 120 km such that, for a specified initial speed and flightpath angle, entry at any point within the associated arc ensures the ability to arrive at the designated target on the surface of the earth. Author

N64-16546 Joint Publications Research Service, Washington, D.C.
SOME GENERAL PROPERTIES OF CENTRAL TRAJECTORIES OF A POINT OF VARIABLE MASS
A. M. Slesarev 11 Mar. 1964 52 p refs Transl. into ENGLISH from Vychislitel'naya Mat. i Tekhn. (Kiev), 1962 p 131–178
(JPRS-23629; OTS-64-21768) OTS: $1.50

This report deals with a qualitative investigation of various possible forms of the trajectories of a point of variable mass in a nonstationary central field of force for the case in which the reactive forces have collinear speed. The most important results obtained are: (1) the classification of the force fields that are introduced; (2) a table of the possible types of motion of a point of variable mass at a finite moment in time; and (3) theorems concerning the behavior of the trajectories of a point of variable mass in a nonstationary, central field of force. I.v.L.

N64-16547 California U., Livermore Lawrence Radiation Lab.
FEASIBILITY OF USING NUCLEAR EXPLOSIVES TO EXTRACT WATER FROM LUNAR ROCKS
R. A. Heckman 25 Sep. 1963 18 p refs Presented at the Mining and Process. Subgroup of the Working Group of Extraterrest. Resources, Colo. School of Mines Res. Found., Sep. 25, 1963
(Contract W-7405-ENG-48)
(UCRL-7515) OTS: $0.50

The feasibility of a proposal to use nuclear explosives for in situ dehydration of lunar water-bearing deposits is investigated. Nuclear explosives are an obvious economic choice over conventional explosives for such use because of their much greater yield-to-weight ratio. For deep water-bearing deposits, contained explosions would be used. A relationship is worked out giving minimum depths for containment of explosions in the lunar environment. These range from 2,000 to 10,000 ft for the explosive yields of 1 to 100 kilotons that are contemplated. It appears feasible to emplace and detonate nuclear explosives at these great depths on the moon, but a complete evaluation of the technique must await knowledge of the geological nature of water-bearing deposits at these depths. For shallow lunar water-bearing deposits, use of "earth-moving" nuclear explosions coupled with mining techniques appears attractive. Author

N64-16563 Mitre Corp., Bedford, Mass.
NOTES ON A NOVEL GNOMONIC NOMOGRAPH OR GRAPHICAL DETERMINATION OF SATELLITE COVERAGE
R. H. Gerhardt Oct. 1963 24 p
(Contract AF 19(628)-2390)
(W-6270; ESD-TDR-63-450; AD-422326)

A graphical method of estimating the time a satellite is within view of a ground point has been devised. This method uses a gnomonic projection of the earth and three overlays: a clock, inclined orbit overlay, and coverage ellipse. Construction of the overlays is described. Overlays and a map are given that may be assembled to form a nomograph for solution of problems. Author

N64-16651 Aerospace Corp., El Segundo, Calif. Systems Research and Planning Div.
LAUNCH VEHICLE PERFORMANCE REQUIREMENTS FOR RENDEZVOUS WITH SATELLITES IN 200-NAUTICAL MILE CIRCULAR ORBITS OF 60 DEGREES INCLINATION
G. L. Coates 15 Dec. 1963 39 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-320; TDR-269(4130-10)-7; AD-429532)

The total ideal velocity required of the launch vehicle to achieve gross rendezvous with satellites in 60-degree inclination, 200-nautical-mile altitude circular orbits was determined as a function of the launch azimuth, the relative epoch of the orbit, and the pass on which rendezvous takes place. A direct ascent launch vehicle trajectory was assumed. Precision flight simulation techniques were used throughout except for the assumption of an impulsive adaptation maneuver. The effects of liftoff time dispersions were not included; the study was rather concerned with the selection and characteristics of nominal trajectories. Author

N64-16726* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL INVESTIGATION OF ELECTRIC DRAG ON SATELLITES
William C. Pitts and Earl D. Knechtel N.Y., Am. Inst. of Aeron. and Astronautics [1964] 5 p refs Presented at the AIAA Aero-Space Sci. Meeting, New York, 20–22 Jan. 1964
(AIAA Paper 64-32) AIAA: $0.50 members, $1.00 nonmembers

It was found that: (1) The electric drag can be significant compared to the uncharged satellite drag. (2) Any theory for electric drag must include both hard collisions of ions on the surface and the shielding effect of the plasma sheath. (3) The drag produced by nonimpacting ions is important for values of a/λ_D below about 10 but can be neglected in the range of practical satellite conditions for which a/λ_D is greater than 10. (4) A simple empirical relation is available that permits rapid estimation of electric drag over practical ranges of interest. Author

N64-16740* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
OUT-OF-PLANE PERTURBATIONS OF A CIRCULAR SATELLITE ORBIT
T. T. Soong Repr. from AIAA Journal, v. 1, no. 12, Dec. 1963 p 2862–2863 refs
(NASA Contract NAS7-100)
(NASA CR-53088; JPL-TR-32-420)

The validity of the first-order approximation for the out-of-plane motion of a long-lifetime satellite was investigated. It is shown in the case of a circular orbit that the effect of small deviations in in-plane parameters on the statistics of the out-of-plane motion may become significant, indicating the need of considering higher-order terms in certain cases. IAA

N64-16749* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE APPLICATION OF LAMBERT'S THEOREM TO THE SOLUTION OF INTERPLANETARY TRANSFER PROBLEMS
James F. Jordan Feb. 1964 24 p refs
(NASA Contract NAS7-100)
(NASA CR-53084; JPL-TR-32-521) OTS: $2.60 ph, $0.92 mf

Lambert's equations are stated and discussed for elliptical, hyperbolic, and parabolic trajectories. Numerical results are obtained for Earth-to-Venus and Earth-to-Mars free-flight transfers, with the assumptions of the two-body (Sun–spacecraft) approximation and constant planetary radii. Straightforward methods, to determine which forms of Lambert's equations are valid for a few specific problems, are presented. Author

N64-16791 RAND Corp., Santa Monica, Calif.
SATELLITE LIBRATIONS ON AN ELLIPTIC ORBIT
H. B. Schechter May 1963 33 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3632-PR; AD-407928)

This memorandum discusses and analyzes the first-order effect of orbital eccentricity on the planar tumbling or

oscillatory motion of a dumbbell-shaped satellite. It is assumed that the angular orientation angle ψ can be represented by a power series in eccentricity e, in which the coefficient of the e^0 term was set equal to the circular solution ψ_c available from earlier investigations. The differential equation for the coefficient of the e^1 term is shown to be of an inhomogeneous Mathieu type, the particular solutions of which can be readily obtained if certain weak restrictions are placed on the initial magnitude of the dumbbell's angular velocity. The analysis indicated that the orientation of the satellite in the elliptic orbit can differ substantially from the one determined for the circular orbit. Author

30 SPACE VEHICLES

Includes launch vehicle-spacecraft combinations; missile systems; operating problems; safety devices; and stability and control. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-16446 Aerospace Corp., El Segundo, Calif. Engineering Div.
ANTENNA LOOK ANGLES AND POWERED FLIGHT TRAJECTORY RESTORATION FROM MISSILE RADIO GUIDANCE OBSERVATIONS AT PMR
J. W. Powers 15 Jan. 1964 36 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-292; TDR-269(4304)-1; AD-430745)

A method is presented for estimating ballistic-missile attitude during the powered-flight period from track and rate observations recorded at the Mk II Complex. The method, which consists of differentiating smoothed velocity data to obtain the total missile acceleration vector in inertial space, permits solution for the thrust acceleration vector, which, on the average for all but near-instantaneous angular velocities, is considered coincident with the roll axis of a roll-stabilized missile. From missile attitudes and accelerations, antenna look angles may be obtained for analysis of ground-to-airborne tracking during powered flight. Author

N64-16570 RAND Corp., Santa Monica, Calif.
LENGTH OF THE LAMINAR HYPERSONIC WAKE DURING THE BALLISTIC RE-ENTRY OF A BLUNT OBJECT
Paul S. Lykoudis Aug. 1963 11 p refs

Numerical results were obtained by using a described method for the calculation of the "ballistic length" of the wake for two ballistic coefficients, namely, w/C_DA = 1,000 and 3,000. The initial conditions taken for the reentry are an angle with a horizontal of 20°, a reentry velocity of 23,900 ft/sec (starting the trajectory), and an altitude of 400,000 ft. For both ballistic coefficients, the length remains almost the same. The dependence of the ballistic coefficient on constant-velocity wake length was also demonstrated. R.T.K.

N64-16709* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL VIBRATION PROGRAM ON A FULL SCALE SATURN SPACE VEHICLE
Charles E. Watson and Kay W. Slayden 26 Apr. 1962 104 p
(NASA TM X-54641; MTP-P&VE-S-62-3) OTS: $9.10 ph, $3.32 mf

The Saturn Block I Dynamic Test Vehicle (SA-D1) was subjected to lateral, torsional, and longitudinal bending mode tests. Transfer functions, relating sensor output to shaker force input, were obtained to aid the Astrionics Division in the design of vehicle control system networks. The report contains bending mode shapes and frequencies with damping factors associated with each mode. Tests were performed at five separate weight conditions as follows: lift-off, 10 seconds, 35 seconds, Q max, and cutoff. Test results indicate a factor of six exists between engine control frequency and the lowest vehicle bending frequency, thus minimizing the possibility of severe engine-vehicle coupling. Author

N64-16754* Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
ROCKET BOOSTER CONTROL. SECTION 13: AN APPLICATION OF THE QUADRATIC PENALTY FUNCTION CRITERION TO THE DETERMINATION OF A LINEAR CONTROL FOR A FLEXIBLE VEHICLE
E. E. Fisher 21 Jan. 1964 30 p refs
(NASA Contract NASw-563)
(NASA CR-53121; MH-MPG-1541-TR-13) OTS: $2.60 ph, $1.10 mf

A linear controller is designed for a typical five-engine flexible rocket booster by use of the quadratic penalty function criterion. Consideration is given to the sensor requirement for controller implementation. It is shown that the optimal controller can be approximated using fewer sensors than the plant order. Author

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes boosters; clustered rockets; and multistage rockets. *For propulsion engines see*: 27 Propulsion. *For manned space capsules, satellites, and sounding rockets and space probes see*: 32 Space Vehicles (Spacecraft). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

No abstracts in this issue.

32 SPACE VEHICLES (SPACECRAFT)

Includes manned space capsules; satellites; and sounding rockets and space probes. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-16352 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIVE DAYS WHICH ELECTRIFIED THE WORLD
O. G. Gazenko *In its* Sci. and Life (Selected Articles) 10 Dec. 1962 p 1–18 (See N64-16351 08-01)

The interesting features of the flights of Nikolayev and Popovich appear to be the duration of their flights as well as

the fact that the two cosmic ships were simultaneously in orbit near each other. The several days that the two cosmonauts remained in orbit permitted the study of: man's ability to work under conditions of long-lasting weightlessness, the cooperation between the cosmonauts, their communication with ground observation points, and their control of the flights. The medical biological investigations conducted by the cosmonauts are discussed in detail. I.v.L.

N64-16460 Library of Congress, Washington, D.C. Aerospace Information Div.
PROCESSING AND PUBLICATION OF THE RESULTS OF OPTICAL OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES IN THE USSR [OBRABOTKA I PUBLIKATSIYA REZUL'TATOV OPTICHESKIKH NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI V SSSR]
N. P. Slovokhotova *In its* IGY Papers on Tectonics, Seismology, and Gravity 3 Feb. 1964 p 59–62 refs (See N64-16451 08-12) OTS: $6.60 ph, $2.15 mf

A total of about 200,000 separate listings of data, which were the results of visual and preliminary photographic observations of Soviet and American satellites, were received by the Astronomical Council in the last 4 years. Such data first are used for the ephemeris service and for obtaining the elements of satellite orbits, and are then published in the special bulletins, "Results of Observations of Soviet Artificial Earth Satellites" and "Results of Observations of American Artificial Earth Satellites," which are issued by the Astronomical Council in cooperation with the Institute of Theoretical Astronomy. The results of precise processing of photographic observations are printed in the "Bulletin of the Stations for Optical Observation of Artificial Earth Satellites of the Astronomical Council." I.v.L.

N64-16692* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EXPLORER XVI MICROMETEOROID SATELLITE. SUPPLEMENT III, PRELIMINARY RESULTS FOR THE PERIOD MAY 27, 1963, THROUGH JULY 22, 1963
Earl C. Hastings, Jr. Washington, NASA, Mar. 1964 38 p refs
(NASA TM X-949) OTS: $1.00

Both of the telemetry systems have ceased to transmit usable experimental data. Power supply systems were operating satisfactorily when these failures occurred, and telemetry temperatures were below design limits in both cases. Punctures were recorded in 44 of the 0.001-in.-thick beryllium–copper pressurized cells and in 11 of the 0.002-in.-thick beryllium–copper pressurized cells. Corresponding puncture rates are 0.031 and 0.016 puncture/ft^2/day, respectively. When expressed in equivalent thicknesses of aluminum, the puncture rates still lie somewhat above the lower previous estimates for that material. No punctures of 0.005-in.-thick beryllium–copper cells have been recorded. Impact detector data indicate higher impact rates than those found in previous impact detector experiments. There appears to be some correlation of impact rate with rate of puncture of the pressurized cells.
Author

N64-16700* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ARIEL I SATELLITE
Robert C. Baumann Apr. 1963 17 p
(NASA TM X 51621; X-673-63-75) OTS: $1.60 ph, $0.80 mf

The Ariel I Satellite is an integrated scientific laboratory specifically designed to obtain knowledge of the ionosphere and its complex relationship to the sun. The scientific laboratory in space is completely self-contained and, other than a single command function, operates independently of external control. A discussion is presented of the components that go into making this space laboratory; the electronics, the structure, and the associated hardware are described. R.T.K.

N64-16719* Smithsonian Astrophysical Observatory, Cambridge, Mass.
CATALOG OF PRECISELY REDUCED OBSERVATIONS NO. P-10 Research in Space Science
Phyllis Stern, comp. 1 Oct. 1963 206 p refs
(NASA Grant NsG-87-60)
(NASA CR-55843, SAO Special Rept. 138) OTS: $14.00 ph, $6.38 mf

Precisely reduced observations of the following are presented: (1) Satellite 1959 α 1 (Vanguard II) from January 1 through June 30, 1962; (2) Satellite 1959 Eta (Vanguard III) from January 1 through June 30, 1962; (3) Satellite 1960 ι 2 (Echo I rocket) from January 1 through June 30, 1962; and (4) Satellite 1961 δ 1 (Explorer IX) from January 1 through June 30, 1962. R.T.K.

N64-16720* Smithsonian Astrophysical Observatory, Cambridge, Mass.
SATELLITE ORBITAL DATA NO. E-3 Research in Space Science
I. G. Izsak 30 Jan. 1964 31 p
(NASA Grant NsG-87-60)
(NASA CR-55851; SAO Special Rept. 141) OTS: $3.60 ph, $1.13 mf

Mean orbital elements are presented for the satellites Vanguard II, Vanguard III, Tiros I, Echo I, Explorer IX, Transit 4A, and Injun 3. The mean orbital elements have been derived from observations covering several days, and short period perturbations due to the earth's oblateness have been eliminated. E.W.

N64-16721* Smithsonian Astrophysical Observatory, Cambridge, Mass.
SATELLITE ORBITAL DATA Research in Space Science
I. G. Izsak 31 Jan. 1964 65 p
(NASA Grant NsG-87-60)
(NASA CR-55853; SAO Special Rept. 142) OTS: $6.60 ph, $2.15 mf

Information on orbital elements is presented for the following: (1) Satellite 1958 Alpha (Explorer I), January 1 through April 1, 1963; (2) Satellite 1959 Alpha 1 (Vanguard II), January 1 through April 1, 1963; (3) Satellite 1959 Eta (Vanguard III), January 1 through April 1, 1963; (4) Satellite 1959 Iota 1 (Explorer VII), January 1 through April 1, 1963; (5) Satellite 1960 Iota 1 (Echo I), January 1 through April 1, 1963; (6) Satellite 1960 Xi 1 (Explorer VIII), January 1 through April 1, 1963; and (7) Satellite 1961 Delta 1 (Explorer IX), January 1 through April 1, 1963. R.T.K.

33 STRESSES AND LOADS

Includes fatigue; vibration; flutter; and structural tests. *For thermal stress see*: 13 Heat Transfer and Thermodynamics. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 34 Structural Design.

N64-16332* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A FLEXIBILITY INFLUENCE COEFFICIENT METHOD FOR DETERMINING THE MODE SHAPES AND NATURAL FREQUENCIES OF SPACE VEHICLES
Nathan L. Beard 13 Aug. 1963 42 p
(NASA TM X-54566; MTP-AERO-63-58) OTS: $4.60 ph, $1.46 mf

A matrix method using flexibility influence coefficients was developed for obtaining the free-free bending and torsional mode shapes, slopes of mode shapes, and natural frequencies of space vehicles. The effects of rotary inertia and shear flexibility are included. The mode shapes and natural frequencies were determined for a typical space vehicle and compared with those obtained from a modified Stodola method. Twenty mass points were used for the influence coefficient analysis and 201 for the Stodola method. This report shows that the influence coefficient method will obtain satisfactory mode shapes and frequencies in comparison to a Stodola method. Author

N64-16490 Army Materials Research Agency, Watertown, Mass. Materials Engineering Lab.
TENSILE SHEET WITH SYMMETRIC EDGE CRACKS WITH LATERALLY CONSTRAINED ENDS
Oscar L. Bowie Dec. 1963 16 p refs
(AMRA TR 63-26; AD-428205)

Conformal mapping techniques are applied to the mixed boundary problem of tensile sheet (with symmetric edge cracks) with laterally constrained ends. For applications to short test specimens in fracture mechanics, the stress-intensity factors for the crack roots are evaluated for varying crack lengths for square sheet. Author

N64-16529 Aeronautical Research Council (Gt. Brit.)
ROOM TEMPERATURE INSTABILITY AND FRACTION IN ROTATING DISCS AND CORRELATION WITH BI-AXIAL TENSILE TEST DATA
N. E. Waldren and D. E. Ward London, HMSO, 1963 32 p refs
(ARC-CP-660; previously issued as NGTE-M-362; ARC-24346)
HMSO: 6s

The room-temperature burst strength and ductility of model discs in a typical ferritic turbine disc material (Rex 535) have been examined. Discs from vacuum-melted bar exhibited remarkably consistent properties. The discs burst when the average tangential stress exceeded the ultimate tensile strength of the material by as much as 7%. A detailed analysis of the more ductile discs supports the use of the distortion energy (Von Mises) and deformation (Hencky) theories for predicting disc instability. In the case of the less ductile discs, results from tubes in biaxial tension confirm failure when this occurs before the point of instability. Author

N64-16533 Aeronautical Research Council (Gt. Brit.)
THE SHEAR STIFFNESS OF A CORRUGATED WEB
K. I. Mc Kenzie London, HMSO, 1963 14 p refs
(ARC-R&M-3342; supersedes RAE-R-STRUCT-275; ARC-24288) Available from HMSO: 6s

An analysis is made of the shear deformation of a corrugated web attached to the flanges at discrete points. The shear stiffness is calculated for a wide variation of the dimensions of the web, and for two positions of the points of attachment to the flanges. Results are presented showing this stiffness relative to that of the continuously attached corrugation. Author

N64-16595 Aerospace Corp., El Segundo, Calif. Labs. Div.
MATERIALS AND STRUCTURES EVALUATION PROGRAM. INVESTIGATION OF THE FREE VIBRATIONS OF MULTILAYERED CYLINDRICAL SHELLS Semiannual Technical Report, 1 Jan.-30 Jun. 1962
V. I. Weingarten 11 Sep. 1962 29 p
(Contract AF 04(695)-69)
(TDR-69(2240-65)TR-2; DCAS-TDR-62-182; AD-291166)

Breathing-mode vibrations of multilayered cylindrical shells were investigated. A simple formula was developed for determining equivalent cylinder parameters for isotropic multilayered shells with each layer having the same Poisson's ratio. These equivalent cylinder parameters can be used in conjunction with available frequency equations for monocoque cylinders. Author

N64-16627 General Dynamics/Fort Worth, Tex. Engineering Dept.
ADHESIVE TORSIONAL SHEAR TEST
L. R. Lunsford 15 Jan. 1964 18 p
(Contract AF 33(657)-11214)
(ERR-FW-134; AD-430327)

A torsional shear jig, loaded in a standard tension–compression test machine, was constructed to simulate a specimen length of overlap to adherend thickness ratio of zero, with a uniformly distributed, pure shear loading that was free of bending or peeling. The jig applies a torsional shear load to the adhesive or braze through a circular specimen, which load produces a peripherally uniform shear stress with linear radial variations. The maximum shear strength at failure represents the ultimate shear strength of the adhesive. Stress-strain curves are obtained by measuring the adhesive strain as a function of load. The shear modulus of elasticity can be calculated from the stress-strain curve (the adhesive must approach the requirements of a Hookian solid). Stress-strain curves have been obtained for AF-31 nitrile rubber phenolic and Plastiloc 620 adhesives. Reproducible results were obtained from the adhesive torsional-shear apparatus, using several sets of specimens bonded with the same adhesive (Plastiloc 620). I.v.L.

N64-16629 General Dynamics/Fort Worth, Tex. Engineering Dept.
DOUBLE REVERSE CORRUGATION CORE (DRC)
C. W. Rogers and J. M. Hayes 15 Jan. 1964 14 p
(Contract AF 33(657)-11214)
(ERR-FW-197; AD-430124)

The objective of the test procedure was to determine the relative strength properties of double reversed corrugated aluminum core with respect to aluminum honeycomb core of the same density. Two panels of 3.94-lb/ft^3 core made from 0.005-in.-gage 2024 aluminum and two panels of 6.83-lb/ft^3 core made from 0.010-in.-gage 2024 aluminum were used in this testing. These panels were cut into smaller pieces, and 53 specimens were used. The results showed that the subject core had approximately 40% to 60% of the strength properties of the reference core. The modulus properties of the subject core were closely related to the method of attachment of core-to-skin bond. Author

N64-16639 General Dynamics/Fort Worth, Tex.
MATERIAL-ADHESIVES-AF-130, METLBOND 329, AND FMS-0015-1-DETERMINATION OF CREEP RESISTANCE OF
J. P. Thomas 15 Jan. 1964 10 p
(Contract AF 33(657)-11214)
(FTDM-3160; AD-430514) OTS: $1.10

Investigations were conducted to determine the permanent deformation of stainless steel sandwich beams at 350° F under load when bonded with AF-130, Metlbond 329, and FMS-0015-1 adhesives. Stainless steel sandwich panels and an aluminum control panel were fabricated. One panel for each adhesive was cut into two sandwich beams and the beams tested for creep at 350° F under load. Deformation was recorded, and the results are listed. C.L.W.

N64-16696 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
A REVIEW OF SOME ELECTRON-MICROSCOPIC FRACTOGRAPHIC STUDIES OF ALUMINUM ALLOYS
W. R. Warke 5 Feb. 1964 12 p refs
(Contract AF 33(615)-1121)
(DMIC Memo-186)

This review is concerned with the fractography of aluminum alloys under cyclic-loading conditions. The first part of the review is a summary of a report that deals with the effect of constituent particles on fatigue crack propagation in 7178 aluminum alloy. The second section contains some recent information on fatigue of aluminum alloys under corrosive conditions. R.T.K.

N64-16829 Massachusetts Inst. of Tech., Cambridge, Mass. Aeroelastic and Structures Research Lab.
A STUDY OF MATRIX ANALYSIS METHODS FOR INELASTIC STRUCTURES Technical Documentary Report, May 1962-Aug. 1963
John H. Percy, William A. Loden, and D. R. Navaratna Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Oct. 1963 216 p refs
(Contract AF 33(657)-8717)
(RTD-TDR-63-4032; AD-432127) OTS: $14.50

Matrix methods of structural analysis for structures exhibiting elastic–plastic and creep behaviors are reviewed. To elucidate the matrix methods, two problems in plane stress, a bending problem and a shear-lag problem, are chosen as examples. Both are analyzed by model matrix analysis programs, for elastic–plastic behavior by the displacement method and by the force method, and for elastic–plastic–creep behavior by the displacement method. Experiments conducted on aluminum shear-lag specimens at room temperature for elastic–plastic behavior and at an elevated temperature for elastic–plastic–creep behavior are described. A critical discussion of matrix analysis methods for inelastic structures is included in the report. Author

N64-16857 Pennsylvania State U., University Park
EFFECTS OF EXTERNAL LOADINGS ON LARGE OUTLETS IN A CYLINDRICAL PRESSURE VESSEL Report Period, 1 Oct. 1962-31 Dec. 1963
Donald E. Hardenbergh and Sam Y. Zemrik 15 Jan. 1964 37 p refs

The aim of this study is to provide data that measure the effects of externally applied loads upon cylinder-to-cylinder junctures in the range d/D from 0.60 to 1.00. Stresses resulting from a bending couple in the longitudinal plane, a bending couple in the transverse plane, and a thrust along the axis of the branch pipes were measured repeatedly. The effect of internal pressure was also studied independently of the effects of external loadings. Author

N64-16858 General Dynamics/Astronautics, San Diego, Calif.
NUMERICAL ANALYSIS OF NONLINEAR ELASTIC BODIES
J. W. Wissmann 7 Sep. 1962 126 p refs
(Sponsored in part by REA-111-9370)
(ERR-AN-157)

A complete theory has been developed for the numerical calculations of linear or nonlinear elastic bodies; this includes solid bodies, shells, trusses, or any combination thereof. The development starts with the very basic principles of theory of elasticity and of the deformation of continuous media. These principles are applied to simple elements of volume and, using the finite magnitude of such elements, the continuous differential equations are transformed into discrete point equations. After the continuous domain has been dissolved into a point set at the earliest level possible within the theory of continuous media, the development follows techniques that are partially known from the linear theory of elastic structures in lumped parameter form. Author

N64-16883 Harry Diamond Labs., Washington, D.C.
FRETTING CORROSION A Literature Survey
Raymond H. Comyn and Cita Wright Furlani 30 Dec. 1963 99 p refs
(TR-1169; AD-430908)

Data from over 200 reports from the English literature on fretting corrosion have been summarized. The actual wear, frictional changes, variations in electrical resistances and electrical noise, and fatigue due to fretting are described to acquaint the designer with difficulties to be anticipated from this problem. Factors affecting fretting, its effect on the fatigue strength of materials, and methods of preventing it are discussed. The main theories that have been proposed to explain fretting corrosion, and test methods that have been used to study it, are reviewed. Author

34 STRUCTURAL DESIGN

Includes structural elements; and weight analysis. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 33 Stresses and Loads

N64-16246 RAND Corp., Santa Monica, Calif.
SELECTION OF MATERIALS IN MINIMUM WEIGHT DESIGN
William R. Micks Mar. 1963 25 p Presented at the Design Eng. Conf. of the Am. Soc. of Mech. Engr., New York, 20-23 May 1963
(P-2729)

This paper discusses the selection of materials as related to the overall process of minimum weight design. Examples are given to illustrate the process and to show the necessity for basing materials comparisons on the proper design parameters. Author

N64-16272* Telecomputing Corp., San Diego, Calif. NARMCO Research and Development Div.
CAPABILITY DEVELOPMENT OF ADHESIVE BONDED STUDS Final Summary Report, 1 Dec. 1962-30 Oct. 1963
F. M. Wilson 15 Nov. 1963 66 p
(NASA Contract NAS8-5188)
(NASA CR-55721) OTS: $6.60 ph, $2.18 mf

This report outlines the development of the load-carrying capability of adhesive bonded studs. Four resin systems and two flexible liners in two thicknesses were investigated, and the test results of the various combinations of these materials indicated the optimum bonding system. Bonding procedures are outlined, and the importance of following these procedures is stressed. This program resulted in a room temperature adhesive system with a load-carrying ability exceeding that of the stud. Author

N64-16412 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

STRUCTURES WITH FOAM PLASTIC FILLERS

A. Ya. Alexandrov, M. Ya. Borodin, and V. V. Pavlov 10 Jun. 1963 257 p refs Transl. into ENGLISH from the book "Konstruktsii s Zapolnitelyami iz Penoplastov" Moscow, Gos. Nauchno-Tekhn. Izd. Oborongiz, 1962 p 1–187
(FTD-TT-63-61/1+2; AD-418030)

This book represents an attempt to collect the material necessary for the design and manufacturing development of structures with foam plastic fillers so as to promote more extensive use. Described are the physical and mechanical properties of foam plastics; examples are given of structures that have been developed and the method of manufacture; and the special features of the operation and design of filled structures, the strength calculations conducted on such structures, and the testing of structural elements with foam plastic fillers are discussed. I.v.L.

N64-16628 General Dynamics/Fort Worth, Tex. Engineering Dept.

FACE WRINKLING AS A FUNCTION OF SURFACE WAVINESS

C. W. Rogers 15 Jan. 1964 25 p refs
(Contract AF 33(657)-11214)
(ERR-FW-196; AD-430258)

An attempt was made to establish the correlation between surface waviness of honeycomb core panels and the face wrinkling attendant upon the panels when subjected to compressive forces. Tests were conducted with honeycomb sandwich edgewise compression specimens with controlled initial surface waviness. A survey of the literature disclosed that previous investigations furnished an excellent base for advancing the state-of-the-art of this widely used form of construction. Although previous researchers had suggested methods of predicting the effects of surface waviness on skin wrinkling when considering only a small degree of waviness, the current testing indicated that by extrapolation these predictions could be applied to panels having a large degree of waviness. Author

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